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AusIndustry Cooperative Research Centres Program

MINEX CRC ANNUAL REPORT

1 July 2022 - 30 June 2023



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1.1 Executive Summary

MinEx CRC had another extremely successful year in 2022/23, and with all research and field operations conducted with no reportable injuries.

MinEx CRC is committed to growing and supporting an equitable, diverse, and inclusive environment where everyone feels safe, valued, supported, and treated fairly with dignity and respect. The MinEx CRC EDI Committee is active, and we strive to achieve our goals in all our undertakings.

MinEx CRC achievements were recognised in numerous awards, including the Drilling Mechanics Team Awarded the Trailblazer Award at Curtinnovation2022. Associate Professor Caroline Tiddy was recognised as a 2022 #SuperstarofSTEM, and UoA researchers won the Research Excellence Team Award at the University of Adelaide.

MinEx CRC's ambitious student targets remain on track, with 37 Postgraduate students currently enrolled. Seven postgraduate students completed their studies in the past year, three of whom went to industry employment. Training and workflow improvement is also being undertaken using a fully immersive Virtual Reality digital twin model of the RoXplorer[®] drilling platform. The model also acts as a technology showcase for stakeholder engagement and commercialisation.

Risk continues to be managed through MinEx CRC structures and reporting requirements. Whilst the COVID-19 risk has receded over the past year, ongoing drilling operations significantly increase both HSEC and financial risk exposure of MinEx CRC.

Participant support for MinEx remains strong, with a total of 48 Participant and Affiliate organisations, an increase of one in the past year. Revenue has exceeded the Commonwealth Agreement Budget in FY23 by approximately \$4.4M, primarily due to additional contributions for the year. Interest Income of \$365,000 also aided the MinEx cash balance, as did the award of a \$500,000 NSW Critical Minerals and High-Tech Metals Activation Fund, being applied to Project 2 and matched by additional Participant contributions.

Participant and researcher interaction occurred on numerous fronts, including a mid-year workshop and a large annual conference. Three episodes of V-News also kept all informed.

Research remains on track, with 198 of the 216 Phase 2 quarterly project milestones that were due achieved at year-end and with cumulative progress against all Phase 2 core project milestones ahead of schedule. Four short-term Opportunity Fund projects were also active and reviewed by the Science Advisory Committee and attained funding approval from the MinEx Board.

The fourth National Drilling Initiative (NDI) Campaign was completed, this time in NSW, and an extensive campaign was undertaken for Anglo American in Queensland. Both campaigns utilised and improved the Coiled Tubing drill rig technology, resulting in press releases and widespread media coverage. Over the year, 119 press articles were generated, and there were 37,000 visitors to the re-relaunched MinEx CRC website.

MinEx CRC is undertaking commercialisation discussions for various projects, and consideration of the structure of Phase 3 of MinEx (2025-2028) has commenced.

1.2 Achievements

The following summarises key achievements of MinEx CRC in the year 1 July 2022 — 30 June 2023.

AWARDS

- Project 1 Drilling Mechanics team led by Masood Mostofi (Curtin University) were recipients of the Trailblazer Award at Curtinnovation2022.
- Caroline Tiddy (UniSA) was selected as a Superstar of STEM for 2022 by Science & Technology Australia.
- Alan Collins, Juraj Farkas, Darwinaji Subarkah, Angus Nixon, Simon Holford, Ros King, Carl Spandler, and Morgan Blades (UofA) were awarded the Research Excellence Team Award for their work on the Greater McArthur Basin at the annual University of Adelaide awards.
- Darwinaji Subarkah (UofA) was the recipient of the 2022 NTGS/PESA SA-NT Student Prize, the Best Northern Territory-focussed Petroleum & Energy Resources Geoscience Research Thesis or Paper for his paper - Subarkah, D., Nixon, A.L., Jimenez, M., Collins, A.S., Blades. M., Farkaš, J., Gilbert, S., Holford, S. 2022. Constraining the geothermal parameters of in situ Rb–Sr dating on Proterozoic shales and its subsequent applications. GChron, 4, 577–600.
- MinEx CRC was awarded a NSW Critical Minerals and High-Tech Metals Activation Fund grant of \$500K to develop the steering capability of the CT drilling platform.
- Internal MinEx CRC awards were presented at the Annual Conference as follows:
 - MinEx CRC 2021 Publications Award: Andrew Clark (GA), Laura Morrissey (UniSA), Michael Doublier (GA), Natalie Kositcin (GA), Anthony Schofield (GA) and Roger Skirrow (ANU) for "A newly recognised 1860–1840 Ma tectono-magmatic domain in the North Australia Craton: Insights from the Tennant Region, East Tennant area, and the Murphy Inlier."
 - MinEx CRC Team Player Award 2022: Cameron Jackson, Drilling Manager (MinEx CRC)

EQUITY, DIVERSITY, AND INCLUSION (EDI)

MinEx CRC is committed to growing and supporting an equitable, diverse, and inclusive environment where everyone feels safe, valued, supported, and treated fairly with dignity and respect.

The following EDI actions were undertaken during the reporting period:

- The MinEx CRC EDI Committee Chair (Anthony Budd, Geoscience Australia) was appointed in November 2022.
- The MinEx CRC Board (excluding the CEO) comprises six members, 50% male and 50% female.
- The MinEx CRC Executive Management Committee, including the CEO, comprises eight members, 62.5% male and 37.5% female.
- Research Leads for the nine primary programs are 78% male and 22% female.

PARTICIPANTS AND AFFILIATES

- 23 sponsoring Participant organisations
- 25 sponsoring Affiliate organisations
- One new Affiliate (Monash University) joined during the reporting period.

A full list of Participant and Affiliate sponsors is included in Appendix D.

SME ENGAGEMENT

- MinEx CRC-designed measurement, monitoring and control systems ("DTrol") have been installed on two drill rigs, a Reverse Circulation percussion drill rig and a Diamond drill rig, operated by MinEx CRC Participant McKay Drilling.
- MinEx CRC maintained its relationship with OMNI GeoX to coordinate and manage aspects of the Delamerian South NDI campaign.
- Participant Imdex Limited provided significant in-kind contributions of people and equipment to research projects and logging equipment for the NDI drilling program. The equipment was a valuable aid to the Project and provided Imdex with important feedback on the use and development of recently released products.
- MinEx CRC's seismic research project conducted field trials at Anglo American, Rio Tinto and BHP field

sites.

 Cooperation is ongoing with European-based METS companies Sandvik, Epiroc and LKAB Wassara.

Staff from the Anglo American London office have become involved with the pull-through of MinEx CRC CT drilling technology, which has prompted discussions with international companies interested in the commercial manufacture of the CT platform.

- Chilean-based drilling company Geotec Boyles remains active in Project 1, with field trials in South America planned for the calendar year 2023.
- Three students undertaking 'Company Sponsored Projects' have continued their research directly affiliated with MinEx CRC industry partners and are complimentary to the broader MinEx CRC research agenda. These projects are concentrated on case study areas of the industry partner. Partners include AIC Mines, Encounter Resources, Inca Minerals, Lodestone Mines, Middle Island Resources and Strategic Energy Resources.

INTERNATIONAL COLLABORATION:

- Cooperation is ongoing with European-based METS companies Sandvik, Epiroc, LKAB Wassara and Sercel. Staff from the Anglo American London office have become involved with the pull-through of MinEx CRC CT drilling technology, which has prompted discussions with international companies interested in the commercial manufacture of the CT platform.
- MinEx CRC and Schramm (an Epiroc subsidiary) have agreed to a commercialisation agreement to build the CT rig and associated Hydraulic Processing System. Subject to orders for CT Systems being placed, Schramm intend to manufacture all CT rigs in Adelaide, South Australia.
- Chilean-based drilling company Geotec Boyles remains active in Project 1, with field trials in South America planned for 2024.

EDUCATION AND TRAINING

- As of 30 June 2023, MinEx CRC had 37 Postgraduate students enrolled.
- Seven MinEx CRC postgraduate students completed during this reporting period, bringing the total number of postgraduate completions to nine. The completing students are employed as follows:
 - > Alexander Simpson (PhD): Postdoctoral Researcher, British Geological Survey (UK).
 - > Angus Nixon (PhD): Postdoctoral Researcher, University of Adelaide.
 - > Darwinaji Subarkah (PhD): Postdoctoral Researcher, University of Adelaide.
 - > Fernando Fontana (PhD): Specialist Geologist LIBS and Data Analytics, Rio Tinto.
 - Hing Hao Chan (Masters by research): Undertaking a PhD project at Curtin University with MinEx CRC Project 1.
 - Mitchell Bockmann (PhD): Project Geologist, Geological Survey of South Australia.
 - Sana Zulic (Masters by research): Consultant Geophysicist with Pragora (Serbia).
- The Mid-year 2022 Postgraduate Workshop was held online in May with 105 attendees.

- Seven video conferences were held throughout the reporting period to engage students and ensure they feel supported within the CRC environment.
- Four students presented at the Annual Conference held in November 2022.
- Three students undertaking 'Company Sponsored Projects' have continued their research directly affiliated with MinEx CRC industry partners and are complimentary to the broader MinEx CRC research agenda. These projects are concentrated on case study areas of the industry partner. Partners include AIC Mines, Encounter Resources, Inca Minerals, Lodestone Mines, Middle Island Resources and Strategic Energy Resources.
- A fully immersive VR digital twin of the RoXplorer[®] CT drilling platform in collaboration with the Australian Research Centre for Interactive and Virtual Environments at UniSA. The digital twin will be used to optimise engineering and user workflows of the drill site, train drillers on the new platform, and act as a technology showcase for stakeholder engagement and commercialisation.

COMMUNICATIONS AND EVENTS

- Two press releases were distributed during the reporting period titled:
 - New Tech Promises Smaller Carbon Footprint in South Australian Drilling Campaign (October 2022).
 - MinEx CRC Clean and Green Drilling Tech: A Step Closer Following Trial In Collaboration With Anglo American (February 2023)
- Three episodes of the MinEx CRC vNews were published on MinEx CRC TV.
- Seven videos were published on MinEx CRC TV, with 2K views.
- 119 press articles were generated.
- The MinEx CRC website was re-built and launched in November 2022.
- There were 37k visitors to the MinEx CRC website, with 74k page views in total
- The '2022 Year in Review' summary document was released and is included as Appendix A to this Annual Report.
- The annual Mid-year Project Integration Workshop was held on 25-26 May in Adelaide, SA, with 193 attendees over two days.
- MinEx CRC's fourth Annual Conference: Frontier Exploration was held on 15-16 November 2022 at the Adelaide Zoo, South Australia. Over 180 delegates attended the conference, spanning 29 organisations.



Hylogger data from a National Drilling Initiative borehole. The data shows relative abundance of minerals in meter increments and can be used to identify rock types and alteration associated with the formation of mineral deposits.

RESEARCH MANAGEMENT

- At 30 June 2023, Researchers had achieved 198 of the 216 Phase 2 quarterly project milestones that were due. We were behind schedule on 18 milestones and ahead of schedule on 38 milestones. The 18 milestones that were behind schedule are expected to be complete by the end of Phase 2. Cumulative progress against all Phase 2 core project milestones was 59.1% compared to a target of 57%.
- Of the four active Opportunity Fund projects during the reporting period, researchers achieved 20 of 23 quarterly milestones. We were behind schedule on three milestones with every expectation to catch these milestones up in Q3 2023.
- Researchers revisited our CT drilling project (Project 2) strategy and milestones as part of a comprehensive Participants Workshop in October 2022. We reviewed priorities in light of competition for researchers' time between Project 2 research, NDI support (tailing off) and manufacturing support (anticipated to ramp up following the manufacturing agreement with Schramm). There was agreement among participants to maintain the ambitious research agenda in Project 2, which is captured by the existing Performance Target (1000m reach, sample quality, positioning and steering) and to pursue an opportunity to bring forward active steering and positioning research from Phase 3 into Phase 2. Revised 2022 Q4 and new 2023 quarterly Milestones were discussed in the October meeting and approved in the December PRP meeting.
- Following advice from Participants during the CT drilling project strategy meeting, we executed a variation to our Project 2 agreement, which provides funding and sets the framework for collaboration with UK-based company AnTech to build and test a steerable bottom hole assembly (BHA) compatible with the RoXplorer CT drill rig. Approximately \$1.1M have been allocated to the steerable BHA work, including a \$500K grant from the NSW Critical Minerals Accelerator Fund (CMAF) scheme, \$435K additional funding from Project 2 Participants and \$165K of existing Project 2 operating expenditure.
- New and re-scheduled quarterly milestones for all MinEx CRC projects were carefully planned during Q4 2022 and uploaded to our Knack internal reporting system during Q1 2023.
- The Science Advisory Committee (SAC) meeting on 5 May 2023 recommended MinEx CRC support for two new Opportunity Fund projects:
 - OP3.1: LIBS for real-time analysis of wet and slurry drill cuttings. \$164K MinEx cash funding, \$169K in-kind from UniSA. Project Leader: Dr Ben van der Hoek, UniSA. The Project is an offshoot of Project 3 designed to assess an alternative application of MinEx-developed LIBS technology to assay slurries (potentially including top-of-hole drill cuttings) with the potential to inform LIBS assay in flooded boreholes.
 - OP8.1: Barcoding metallogenesis. \$200K MinEx cash funding, \$175K MinEx Participant cash funding, and \$325K in-kind from ANU, UniSA and MinEx Participants. Project Leader: Assoc. Prof. Marnie Forster, ANU. The Project is a continuation of OP8, designed to deliver Ar/Ar step heating analyses and modelling of Ar/Ar data for thermal histories and dating mineralisation.

Project agreements have been drafted for the two new opportunity fund projects and are due to be executed in early Q4 2023.

RESEARCH HIGHLIGHTS

Drilling optimisation and automation

- We are developing a detailed understanding of drill/rock interactions and identifying 'sweet spot' drilling parameters for rotary (diamond) and reverse circulation (RC) percussion drilling techniques. Our diamond drilling 'sweet spot seeking' algorithm, which uses measurement-while-drilling data to identify and maintain optimum drilling parameters without driller intervention, has been tested in a controlled setting with encouraging results. Commissioning of the "*Woody*" single impact percussion drilling experimental set-up is complete, and we have embarked on an extensive range of experiments designed to identify key drill/rock parameters in percussion drilling. Data from these experiments will underpin a percussion drilling optimisation approach comparable to the diamond 'sweet spot seeking' algorithm. This work is the focus of ongoing collaboration with MinEx CRC Participant Sandvik.
- The MinEx CRC-designed measurement, monitoring and control systems ("*DTrol*") was permanently installed on an RC percussion drill rig operated by MinEx CRC Participant McKay Drilling in 2022. Following commissioning and debugging exercises within a controlled drilling environment close to Perth, the rig was mobilised to McKay drilling operations in the Pilbara. The RC drill rig, fitted with *DTrol*, has been in near-constant operation since then and has been visited twice by MinEx CRC researchers. In Q4 2022, ten months after installation, MinEx CRC researchers revisited the rig and were immediately able to activate the RC *DTrol* system and collect drilling data over three consecutive days. In Q2 2023, the visiting research team made improvements to the *DTrol* system to enable two-way digital communication between the drill rig and the *DTrol* control system, not only receiving drilling data (as previously) but also allowing transmission of control commands to the drill rig, which paves the way for next step in the automation.
- To increase production of *LiqiCTrol*, we designed, fabricated and commissioned a new production plant at Curtin University. The plant is an essential component in progressing the TRL of the *i-fluid* automation system, where we can create and tag batches of *LiqiCTrol* and monitor their performance in the field. With 1 tonne/day capacity (a 10-fold increase compared to our previous production method), the plant can deliver *LiqiCTrol* to service between 6 and 10 field-deployed i-fluid systems.



MinEx CRC Coiled Tubing drilling platform on site at the Paterson National Drilling Initiative Program in Western Australia.

We have now commissioned a prototype CT 1000m drill rig and drilled two trial holes.

- The first hole (CNDEL01) was drilled in the Delamerian South NDI campaign area in Q3 2022. The drill rig performed well. However, the hole depth was limited to 350m because a radial weld in our 1000m coil failed after two bending cycles. The failure was reported to our coil supplier, Tenaris, who is reviewing the radial weld process. A continuous 1000m coil (with no radial welds) was shipped from Houston and arrived in late Q3. At the completion of CNDEL01, we could trial a new process cementing the entire hole, from bottom to top, with cement delivered via the coiled tubing. This process, which ensures the sealing of all aquifers intersected by the drill hole, was required by Anglo American before the Queensland drilling deployment in Q3/Q4 2022 and was regularly used at the Anglo American deployment.
- The second hole (NDIWMP01) was drilled to a depth of 700m in the Delamerian Margins NDI campaign area in Q2 2023. This is the deepest hole so far drilled by the RoXplorer CT platform. Despite difficult ground conditions, the hole was drilled without incident, with good sample recovery at an average 'all-in' drilling production rate of >40m per shift. The drill hole was cased to 30m, with LiqiCTrol in combination with the iFluid system providing hole support, sample protection, and cuttings return in 670m of open hole drilling.

Downhole Assay

- Surface roughness of the borehole wall was identified as a key challenge for the downhole LIBS tool after the visit to our labs by new Participant Rio Tinto in Q3 2022. In response, researchers assessed alternate rapid auto-focus mechanisms and identified a high-speed deformable lens as our preferred technology to address this challenge. The hardware and software required to test the deformable lens technology (in a form suitable for integration into our downhole tool) has been commissioned, and preliminary work is encouraging. The focal distance of the device can be varied over centimetres in fractions of a second.
- Other modifications of the prototype LIBS tool have been made in preparation for downhole trials planned for 2024. This has included a redesign of the modular optical front-end, modification to the lens controller, addition of temperature sensors (acknowledging the effects of temperature on LIBS spectra) and testing of the spectrometer temperature control.
- The GeoLIBS software, incorporating a unique machine learning-based spectral modelling approach, was tested on the high-performance cloud-based digital services (CSIRO Earth Analytics Science and Innovation Hub) to assess computing time and process optimisation. Researchers expect that there will be ongoing improvements to GeoLIBS throughout the life of MinEx CRC. However, a functioning prototype version will be available prior to field trials in 2024.

Logging-while-drilling petrophysics

• The prototype downhole swept frequency EM tool is now at the advanced laboratory testing stage, having undergone multiple incremental upgrades to the sensor and housing, followed by testing after each upgrade in the National Geosequestration Laboratory (NGL) borehole at Curtin University. The tool and housing have now been tested in the NGL borehole to a depth of 450m without leakage. Depth (with resolution of ~20cm), time and EM data are collected routinely in the borehole. EM data are collected at 200 Hz intervals between 2000 and 8200 Hz and converted to a common data format to be displayed in the commercial WellCAD software package. The sensor has proved highly sensitive over a wide frequency range, and the logging results compare favourably against a computed synthetic response based on commercial induction logging of the NGL borehole. These results inform modelling of the expected response of the new tool across a resistivity range of 1 to 1000 Ohmm (the expected range of most rock types), which will inform the development of the swept EM processing software.

- A draft patent application for the downhole swept frequency EM tool has been prepared in close collaboration with MinEx CRC Participant Imdex Ltd.
- Designs for a version 1 Time Domain EM tool are complete, and construction of a laboratory prototype is underway.

Seismic in the drilling workflow

- Researchers continued our ambitious field program designed to test and optimise source and receiver parameters for optic fibre distributed acoustic sensors (DAS) in hard rock seismic applications. This included:
 - Utilising our instrumented borehole DAS array at Anglo American's Moranbah deposit, central Queensland, for a passive seismic experiment using noise from long-wall mining and drilling activity as seismic sources.
 - Completing a DAS land streamer experiment on a Rio Tinto site in the Pilbara, Western Australia. The land streamer was 300m long and was moved 23 times, covering over 3km along two adjacent tracks. Researchers compared acquisition using 'standard' optical and 'tactical' cables. The tactical cable delivered better results and was easier to deploy than standard cable.
 - Conducting a passive seismic experiment using a DAS surface array at the BHP 'Bonobo' site in the Pilbara, Western Australia.
 - Conducting trials of i) downhole sparker source and ii) three-component surface source coupled with borehole DAS in the National Geosequestration Laboratory (NGL) borehole at Curtin University.
- Researchers tested two machine learning approaches for denoising DAS seismic data: a traditional supervised methodology and a noise-to-noise approach. The noise-to-noise approach proved remarkably effective at minimising noise and highlighting the seismic response of the near-hole formation in borehole DAS data. The machine learning approach was prompted after the MinEx CRC seismic research team hosted a workshop in February 2023. The workshop, "Deep Earth: leveraging neural networks for Earth Discovery and monitoring objectives", was facilitated by visiting Professor Tariq Alkhalifah (King Abdullah University of Science and Technology, Saudi Arabia).



Red-Green-Blue false colour image of chemistry from an ~5cm wide polished slab of drill core showing mineral compositions and textures. Samples that are characterized in detail are used to better understand the analytical response of MinEx CRC's novel analytical techniques such as downhole Laser Induced Breakdown Spectroscopy (LIBS).

Automated 3D modelling

• Researchers have developed QGIS plugins for many of the 3D modelling software modules developed by MinEx CRC. QGIS is a free, open-source geographic information systems package allowing access to our 'Loop' suite of software, including the dh2loop, map2loop, loop 3D modelling and Tomofast geophysical inversion capabilities without third-party licensing.

Geological characterisation of mineral systems and cover sequences

- Researchers developed a semi-automated workflow to deliver near real-time identification of regolith/basement interfaces in drilling samples. The workflow has proven successful in case studies from the Cobar area and the Delamerian Margins NDI campaign. Field data collected by portable scanning instruments such as pXRF and portable radio-spectrometers can be reduced to an optimised subset of geochemical and spectral variables using machine learning techniques. These variables are subjected to multiscale spatial analysis using the Data Mosaic software, which delivers objective identification of key interfaces and allows rapid construction of pseudo-logs. These data can make immediate data-driven geological interpretations and/or validate more traditional visual logging techniques.
- Enhanced detection of cover interfaces using novel airborne electro-magnetic inversion techniques has been favourably tested in the vicinity of NDI boreholes in the Delamerian Margins NDI campaign.
- 3D modelling and geophysical inversion in key central and southern Cobar Basin areas has been undertaken to identify connections between the broad-scale architecture and the localisation of mineral deposits. The unconstrained inversion outputs highlighted source bodies reflecting the CSA, Peak Gold and Nymagee deposits and identified underexplored prospective rocks within the Cobar mineral system. This work will be integrated with petrophysical and mineralogical studies, including undercover geophysical characterisation and distribution of known mineral deposits and prospective rocks. Preliminary petrophysical work indicates that remanent magnetisation accounts for a component of the magnetic signature of the Cobar deposits and will be important to consider when using magnetics as an exploration tool.
- A select group of 'downstream' analytical techniques are emerging as the most useful for delivering exploration-relevant data from the drilling. This includes well-established techniques (e.g. U-Pb dating coupled with multi-element analysis of zircon and monazite; Ar/Ar thermochronology) and lesser-known technologies that MinEx CRC has helped to develop (e.g. in-situ Rb-Sr, Lu-Hf and Re-Os dating of ore, gangue and alteration phases; Cu-isotopes; apatite chemistry for characterising mineral systems).
- MinEx CRC researchers have published several papers outlining the development and application of in-situ laser analysis for the same mass isotopes (e.g. Rb-Sr, Lu-Hf, Re-Os). The first results on establishing age standards for these techniques look promising and match well with expected ages of the standard materials. A report on Rb/Sr isotope tracing and geochronology from the Delamerian NDI campaign is complete and uploaded onto the MinEx CRC SharePoint.

NDI and Partner sponsored Coiled Tubing drilling campaigns

• The CT 500m drill rig and HPS were deployed at the Anglo American' Diamantina Project' west of Boulia in Queensland between August and December 2022. Our challenge was to drill through 400 to 450m of complex cover, take core from fresh bedrock, survey and log the hole with the Imdex EZYGamma tool, and cement the hole from the bottom up. The Project provided an opportunity to review and improve the environmental and safety aspects of the CT500 infrastructure and operating procedures to comply with the high standards required by Anglo American. We drilled 12 holes for a total of 5240m at the Diamantina Project. achieved

consistently high drilling productivity during the deployment, averaging 54m per shift (including site moves, set-up, collaring, core drilling, surveying, gamma logging and cementing).

• The Delamerian Margins NDI campaign was conducted between March and June 2023. The Campaign used a conventional rotary mud-diamond drill rig and the MinEx CRC CT500 and CT1000 drilling platforms. Drilling conditions were challenging, with all rigs suffering significant fluid losses in unconsolidated cover materials. The conventional rig drilled five holes for 1,862m, the MinEx CT500 rig drilled ten holes for 2,014m, and the CT1000 drilled one hole for 700m. Performance of the CT platform in terms of drilling productivity was reduced compared to the Delamerian NDI and Anglo American campaigns of 2022 but compared favourably to the conventional drilling platform operating in the same conditions.

NDI sampling and analysis

- A Delamerian NDI sampling workshop was held at the SA core reference library following the completion of the drilling campaign in July 2022. Samples were identified and dispatched to MinEx CRC researchers to conduct; i) an Ar/Ar study (to complement ongoing argon work on legacy samples from the Delamerian area); ii) in-situ Rb-Sr analyses to date alteration minerals; iii) an igneous geochemistry project to augment the PhD work of Stacy Curtis and; iv) a porphyry mineralisation fertility project, including pyrite chemistry, that will build from the work of previous GSSA embedded researcher Wei Hong.
- As part of the Delamerian Margins NDI campaign MinEx CRC collected borehole petrophysical data (natural gamma, magnetic susceptibility, electrical conductivity and resistivity) along with field-acquired portable X-ray fluorescence (pXRF) geochemistry and handheld visible to near infrared (VNIR) spectroradiometry. Soon after drilling, key information from each drill hole, including sample photography, borehole petrophysics and field-acquired geochemical data, were reviewed for quality control and uploaded to the MinEx CRC data portal where the public can access them in the form of a 'Borehole Activity Report'.



High quality spectra obtained using MinEx CRC's novel downhole Laser Induced Breakdown Spectroscopy (LIBS) tool. Each coloured trace represents a single multielement analysis. Many analyses will be grouped and averaged to deliver downhole geochemistry over intervals chosen by the user.

- Utilising a combination of machine learning and geospatial techniques, MinEx CRC researchers generated 'pseudo-logs' based on the Delamerian Margins NDI field-acquired analytical data. The pseudo-logs provide a powerful and objective means of rock characterisation, which were used to help identify samples for detailed 'downstream' analyses, including petrology, geochemistry, geochronology and isotope studies.
- Three campaigns of core logging, data acquisition, and sampling of the legacy Nifty drill core were completed between May and August 2023. Conventional core logging and sampling was informed by company logging, geochemistry and Hylogger and accompanied by a collection of handheld gamma and pXRF data. Samples from the Nifty legacy drill core have been dispatched to researchers and are undergoing analysis, including; carbonate samples for Lu/Hf geochronology, shale samples for Rb/Sr isotopes and geochronology, sulphide bearing samples for Cu-isotope studies and 230 samples for detailed petrophysical analysis.



Coiled Tubing drilling cuttings (chip) samples from the Delamerian Margins National Drilling Initiative.

1.3 Research Case Study

Delamerian Margins National Drilling Initiative (NDI) campaign

MinEx CRC collaborated with Geoscience Australia and the Geological Survey of New South Wales to conduct the National Drilling Initiative (NDI) Delamerian Margins drilling campaign between March and June 2023.

The NDI is a collaboration between MinEx CRC, Geoscience Australia, all Australian state and territory Geological Survey Organisations, CSIRO and Universities, delivering drilling programs in multiple case study areas across Australia. The NDI vision is to drill multiple holes in a region to map the regional geology and architecture and define the potential for mineral systems in three dimensions. To date, the NDI has included drilling campaigns in the Northern Territory (the East Tennant campaign comprising ten drill holes and ~4000m of drilling and the South Nicholson campaign comprising one drill hole for 1750m) and South Australia (the Delamerian Campaign comprising 23 drill holes, for 1980m of conventional drilling and 4650m of CT drilling).

Underlining the collaborative nature of MinEx CRC research, the Delamerian Margins NDI campaign is a key component of Geoscience Australia's Darling-Curnamona-Delamerian (DCD) project within the Exploring for the Future program. The DCD project uses various geological and geophysical tools to assess the broad-based resource potential of the DCD region, including minerals, groundwater and natural hydrogen. Airborne electromagnetics (AEM), magnetotellurics (MT), seismic reflection and geochronology from legacy drill samples were conducted as part of the DCD project leading up to the Delamerian Margins NDI campaign. The Delamerian Margins campaign area is contiguous with the previous Delamerian NDI campaign area; both focussed on an important but little-understood geological province known as the Delamerian Orogen.

The Delamerian Orogen covers approximately 240,000 km² and wraps around the south-eastern margin of Proterozoic Australia, through western New South Wales, southeast South Australia, and Western Victoria and extends into western Tasmania. It is considered the relic of an approximately 500-million-year-old ocean-continent margin, broadly comparable to the modern western Pacific margin, with significant potential for undiscovered precious and base-metal mineral deposits.

The Delamerian Orogen represents a microcosm of the Australian (and global!) mineral industry where there is a fundamental impediment to current and future mineral discovery. Most of the rocks with the potential to host new mineral discoveries are buried by a veneer of sedimentary rocks and weathered materials, which deny explorers the option of direct observation, obscure the geophysical and geochemical response and increase the cost of sampling and analyses because drilling is required. Drilling has inherent safety risks and environmental impact (through its footprint on the landscape, water and fuel consumption and carbon dioxide emission) and is time-consuming and expensive. The combination of high drilling costs and uncertain outcomes means that fewer holes are drilled in these 'covered' geological terranes. Key geological questions remain unresolved, and prevailing uncertainty inhibits further exploration investment. This vicious cycle lies at the heart of the 'challenge of cover'.

Only a small percentage of the Delamerian Orogen is exposed at the Earth's surface. Most of the orogen, including the entirety of some of the component geophysical domains, is buried by relatively young sedimentary rocks of the Murray Basin. These sediments conceal the true nature of the Delamerian Orogen (the distribution and age of rock types, metamorphic grade, geological structures and alteration styles) and are a significant impediment to mineral exploration because they are difficult to drill. The Delamerian Margins NDI campaign addressed both of these barriers to mineral exploration by 1) delivering drilling samples from previously unknown rocks chosen to

provide key insights on the mineral potential of the Delamerian Orogen and 2) testing and demonstrating the efficacy of CT drilling in the challenging drilling conditions of the Murray Basin.

A key part of the MinEx CRC strategy has been the development of Coiled Tubing (CT) drilling for mineral exploration. The CT drilling platform developed by MinEx CRC includes a drill rig with 500m of continuous steel drilling pipe spooled onto a reel, coupled with a hydraulic processing system (HPS) designed to manage the drilling fluid and ensure the collection of high-quality samples. The CT drill rig and HPS are bottom-up engineering projects, unlike any commercially available mineral exploration drilling platform. Their design has been informed by fundamental research (mechanical engineering, materials science, fluid mechanics, separation science and sampling theory, optic fibre sensing and communications) conducted within MinEx CRC and building on the legacy of Deep Exploration Targeting CRC (2010-2018). The MinEx CRC CT drilling platform provides an efficient tool for exploration under cover. The Delamerian Margins NDI campaign has allowed us to test and improve our CT drilling infrastructure and workflows and to benchmark the performance of the CT drilling platform with conventional drilling technologies.

Before drilling, Geoscience Australia and MinEx CRC staff and contractors engaged in extensive stakeholder liaison, including state and local government agencies, landholders and Traditional Owner groups. Landholders were contacted individually to discuss land access, cultural heritage assessments, environmental concerns and biosecurity measures. There was continuous communication during the drilling campaign to minimise disruption to landholder activities.

Drilling took place between March and June 2023. In total, there were 17 holes drilled in the Delamerian Margins NDI campaign; six holes were drilled with a conventional rotary mud/diamond rig (2500m), and 11 holes were drilled with the CT drilling platform (2714m). The CT holes were drilled more quickly, with less water, lower fuel consumption and lower carbon footprint than the conventional drill holes, delivering significant cost savings and environmental advantages.

As part of the Delamerian Margins NDI campaign MinEx CRC collected borehole petrophysical data (natural gamma, magnetic susceptibility, electrical conductivity and resistivity) along with fieldacquired portable X-ray fluorescence (pXRF) geochemistry and handheld visible to near infrared (VNIR) spectroradiometry. Utilising a combination of machine learning and geospatial analysis techniques, MinEx CRC researchers have developed workflows to generate data-centred 'pseudo-logs' based on the field-acquired analytical data. The pseudo-logs provide a powerful and objective means of rock characterisation, which can be used in combination with (or as a validation of) visual geological logging for near real-time decision-making during the drilling deployment.

Soon after drilling, key information from each drill hole, including sample photography, borehole petrophysics and field-acquired geochemical data, were reviewed for quality control and uploaded to the MinEx CRC data portal, where they can be accessed by the public in the form of a 'Borehole Activity Report'.

Preliminary observations from the drilling samples allow the hypothesis that the Delamerian Orogen in the area between Broken Hill and Wentworth comprises a paired continental magmatic arc and back-arc of the Cambrian age. The back-arc domain continues into the Quandong Vale area of eastern South Australia, where comparable rocks were sampled in the Delamerian NDI campaign in 2021. Back-arc sequences are typically prospective for volcanic-hosted massive sulphide deposits rich in copper, lead and zinc. The magmatic arc, sampled only in the most southern drill holes of the Delamerian Margins NDI campaign, has the potential to be a northern continuation of the Staveley Belt in western Victoria. Magmatic arc sequences are typically prospective for porphyry and epithermal deposits rich in copper, gold, molybdenum and silver. Targeted downstream analyses on selected drill cores and cuttings will test this hypothesis.

The field-acquired data-informed subsampling of the drill core and cuttings for further analyses. The subsamples have been submitted to MinEx CRC Partner research organisations for detailed petrology, geochemistry, geochronology and isotope studies to build a more complete picture of the geological evolution and mineral prospectivity of the covered portions of the Delamerian Orogen.

The Delamerian Margins NDI campaign provides a case study of the MinEx CRC approach to mineral exploration R&D – with a dual focus on 1) developing technologies designed to reduce the technical risk and increase the efficiency of exploring beneath cover and 2) going about the practical business of drilling and sampling in under-explored frontier mineral provinces.



MinEx CRC Coiled Tubing drilling platform and support vehicles on site during the Delamerian Margins National Drilling Initiative Program in collaboration with the Geological Survey of South Australia.

1.4 Risks & Impediments

MinEx CRC recognises that it operates in an uncertain environment in which identification and management of risk and risk mitigation are important to our success. Risk management has been built into MinEx CRC structures and reporting requirements from the Project to the Board level. The Board Audit and Risk Committee oversees risks that may impact MinEx CRC's ability to achieve our vision.

Risks are summarised and addressed in the attached table, with the following notes:

- COVID-19 risk has receded over the past year and is now treated as a risk similar to other health risks.
- Ongoing field work involving the CT Rig and field crew significantly increases risk exposure to MinEx, which is reflected in the top three risks listed.
- The focus of MinEx CRC is changing from primarily research to commercialisation of the research; hence, the risk landscape is evolving, reflecting this.

Note that any identified impediments to MinEx CRC effective operation are viewed as risks to ongoing operations here and are not addressed separately.

The three highest risks currently faced by MinEx CRC are listed in Table 1.4.1 with other notable risks listed in Table 1.4.2. The strategies adopted to address the risks are listed as controls that are in place and mitigating factors that exist.

| RISK ISSUE | CONTROLS IN PLACE | MITIGATING FACTORS |
|--|--|---|
| Public Image: Damage to Public Image or reputation | * Monitor ongoing compliance with legal and contractual requirements * Communications Strategy * Key Management focus | * Experienced Board * Crisis Management Plan |
| OHSE Performance: Failure to develop policies and achieve satisfactory OHSE performance and comply with Client specific and/or legal obligations | * OHSE Policy in place * OHSE reporting regime in place * Detailed OHSE Risk Assessment completed for NDI and Industry drilling campaigns. * Specific mitigation steps in place, eg journey management | * Apart from Drilling Campaigns, most CRC activities are relatively low-risk. * Risk assessment completed for each Campaign and implemented on-site. |
| Low Productivity of Drill Crew and | * Funds committed by NDI and | * Potential to offset costs |
| Equipment resulting in insufficient | Industry participants are from | through usage in MinEx |
| revenue to cover costs: | friendly clients | CRC projects |
| a) Insufficient demand for CT drilling | * Ability to reduce costs | * Additional drilling |
| b) Inability to execute CT drilling | * Detailed planning and budgeting | contracts or funds |
| c) Equipment not suitable for ongoing | | * Ongoing R&D |
| use | | * Maturity of system |
| d) Breakdown and maintenance of CT | | |
| Drilling system | | |

Table 1.4.1: Highest rated risks for MinEx CRC at 30 June 2023.

| Crisis Management: Business Continuity and crisis management. Failure to develop and implement suitable strategies | * Risk Register process and Management controls * Approved Crisis Communications plan * Detailed plans and procedures in place | * Experienced Board and Management Team * Initial Crisis Management Plan |
|--|---|---|
| Inadequate Research Information Integrity, including material IT system exposure: Protection and security are inadequate, including IT exposure As highlighted by increased focus from the Commonwealth | * Research Organisations have a high level of experience in this area. * Current project agreements comply with statutory requirements. | * Diversification of research information and IT systems across research projects and research institutions |
| Failure to Execute Drilling Projects: a) Reliability of required drilling equipment, spare parts and support b) Community and Land access issues c) Integration of the Drilling Campaign with the Research Projects | * Drill equipment and CT long-lead items in the current workflow * Proactive approach adopted for ground access * Expert drilling advice being utilised * Structure and process in place to maximise integration * Detailed Plan development, including 2023 and 2024 Campaigns | * Experienced personnel and learnings between states, including Drilling Manager * Process has commenced in a timely manner and regularly monitored * Alternative drilling techniques available * Closely managed relationship between research and execution teams * Track record of successful completion of drilling campaigns |
| Cash Management and Fraud: a) Loss of funds or income due to fraud c) Loss of funds or income due to poor debtor management b) Loss of funds or income due to poor investment returns | * Best practice fraud prevention in place * Low-risk investment policy * Rigorous debtor management and a small number of Debtors and invoices | * Spread of funds across accounts & low-risk Banks * Conservative investment policy |
| Research Portfolio Failure to: a) Meet industry requirements b) Maximise outcomes from Opportunity Fund | * Project agreements with Milestones & budgets * Ongoing Project reporting & tracking * Project review panels include Participants | * Diversification of research portfolio across sectors, researchers and participants * Track record of efficient Opportunity Fund leverage |
| Cyber Security Head Office: Unauthorised access to systems, loss of key data, and inability to operate IT systems | * Expert professional support * Regular review and updates * Current best practice * Experienced staff | * Diversification of information and IT systems across various independent platforms * Ongoing support from IT consultant |

| Staff Retention and Diversity: | * Active diversity and inclusion | * MinEx CRC track record and |
|----------------------------------|------------------------------------|-------------------------------|
| Failure to achieve satisfactory | strategy | reputation established |
| Staff retention and diversity of | * Market-based employment | * Depth of experience of pool |
| Head Office Management and | conditions | of candidates increasing |
| Researchers | * Monitoring of staff turnover and | * Management focus in these |
| | diversity | areas |
| | | |

Table 1.4.2: Notable risks faced by MinEx CRC at 30 June 2023.

1.5 Education and Training

MinEx CRC's key education goals are; 1) to achieve 50 postgraduate completions, and 2) to develop a framework for Vocational Education and Training (VET) in coiled tubing (CT) drilling.

Vocational Education and Training

A key component of MinEx CRC's VET program is training of drillers and drill crew for Coiled Tubing (CT) drilling operations to support our research project and service National Drilling Initiative (NDI) drilling campaigns. Training has been done progressively and in-house using formal driller training schedules based on the Training Needs Analysis conducted by MinEx CRC in 2020. This involves components of classroom (work, health and safety + introduction, history, theory and practicalities of CT drilling), workshop (technology familiarisation, maintenance) and in-field (work, health and safety practicalities, observation and supervised learning of operations tasks) learning. At 30 June 2023 MinEx CRC had trained three drillers (with two employed in ongoing drilling deployments) and 5 drill crew (with 4 currently employed) in CT drilling operations.

A second component of our VET strategy is to develop virtual reality (VR)-based training for drill rig operators and drill crew. We have developed a highly realistic VR drill site incorporating the RoXplorer® coiled tubing drill rig and associated HPS system. The platform is usable with and without VR hardware to ensure broad accessibility. The forward strategy for the VR project is to identify, implement, and evaluate a training module using a mixture of simulated elements (e.g., interactable buttons, levers, rig animation) and embedded media (e.g., photos, videos, training documents). An augmented reality (AR) model was also developed, enabling visualisation of a model drill rig using an iPad or iPhone camera. The VR and AR platforms have been used in promotional activities of MinEx CRC, including for the MinEx PDAC showcase and at the Annual Conference.

Higher Degree by Research (HDR) Program

MinEx CRC progress of student enrolments, progression and completions towards meeting its target of 50 postgraduate student completions is tracked via a student pipeline developed as part of the Postgraduate Education Business Plan. As of 30 June 2023, three Masters by research and six PhD students had completed. Three new Masters by research and seven new PhD students were registered within the reporting period bringing MinEx CRCs active postgraduate cohort at 30 June 2023 to 37. This includes five Masters by research and 32 PhD students. Of the active students, three PhD students had submitted their thesis for examination. The student register listing all active students and project details as of 30 June 2023 is attached (Appendix B).

Leading into the final stage of postgraduate student commencements, the E&T Committee has been closely monitoring the use of allocated and intended use of unallocated bursaries. Strategies have been developed to allocate unspent bursaries to support existing or new MinEx CRC postgraduate students. New postgraduate projects continue to be developed. Projects were advertised online only through the MinEx CRC website, SEEK job adverts, university websites, social media and professional societies. The advertising attracted significant interest and will be used to meet the final round of enrolments sought through the next reporting period.

MinEx CRC support for HDR students

The MinEx CRC Education and Training Committee maintains oversight of the HDR program, including development of new projects, monitoring student progress and providing support to the HDR cohort. High-risk students are a specific agenda item at quarterly E&T Committee meetings. Supervisors and the students monitor student progress towards completion, and factors including difficulty with experimentation, analysis and impacts of Covid-19 are considered. Students listed as high-risk are contacted regularly to offer support as appropriate and are further supported by their supervisors and the student cohort through monthly online video conference sessions.

Recognising the challenging environment for student retention due to strong industry demand for mineral exploration and mining graduates, the MinEx CRC E&T Committee has implemented the following strategies to attract, support, retain and ensure timely completion of postgraduate students:

- A \$20,000 per annum bursary for each HDR student (three years x \$20,000 = \$60,000 for PhD students, two years x \$20,000 = \$40,000 for Masters by research students). This funding is provided irrespective of whether the student holds other scholarships or stipends. The funding is intended to support the student and their Project depending on the individual needs of each student as determined by the supervisory panel. Common uses of the bursary include scholarship support, scholarship top-up, project operational expenditure (travel and analyses) and conference support.
- A completion bonus of \$3,000 for PhD students and \$2,000 for Masters by Research students.
- Financial support for Honours and Masters by coursework students undertaking MinEx CRCrelated research activities and who may go on to undertake a MinEx CRC postgraduate research project. This strategy raises the profile of MinEx CRC with undergraduate students and allows advertising of projects across multiple universities. The initiative has attracted three highquality students to the MinEx CRC postgraduate program. One Honours and four Masters by coursework students completed their projects during the reporting period and there are two Honours and 11 Masters by coursework students currently enrolled. Research topics are summarised in Appendix B.
- MinEx postgraduate students are invited and encouraged to be part of CRC's Equity, Diversity and Inclusion Committee. Three PhD students sat on the committee during the reporting period.
- HDR candidates are deeply connected to government, mining industry and METS Partners. All MinEx CRC postgraduate students are required to have a MinEx CRC Participant or Affiliate industry co-supervisor. This process requires sign-off from a MinEx CRC Participant or Affiliate industry representative with whom the project aims and objectives have been co-developed with academic supervisors. Industry/end-user co-supervisors include staff from AIC Mines, Anglo American, BHP, CSIRO, Department of Energy and Mining/Geological Survey of South Australia, Encounter Resources, Geological Survey of New South Wales, Geological Survey of Victoria, Geological Survey of Western Australia, Geoscience Australia, Inca Minerals, Lodestone Mines, McKay Drilling, Middle Island Resources, Northern Territory Geological Survey, South32 and Strategic Energy Resources.



Completed MinEx CRC and University of Adelaide PhD student Mitchell Brockman preparing samples for analysis.

Three students (Travis Batch, Richard Hill, Ruiqi Zheng) are undertaking Company Sponsored Projects complimentary to the broader MinEx CRC research agenda. These projects are concentrated on case study areas of the industry partner. Partners include AIC Mines, Encounter Resources, Inca Minerals, Lodestone Mines, Middle Island Resources and Strategic Energy Resources.

Two students undertook internships with industry end-users CSIRO and the Geological Survey of Western Australia during the reporting period.

Students are involved and present at quarterly Project Review Panel meetings and workshops for MinEx CRC Participants and Affiliates where appropriate. For example, University of Adelaide PhD candidate Zara Woolston participated in the 'Nifty' National Drilling Initiative predrilling workshop and has collected samples from the GSWA collection for use in her Project.

• HDR candidates are strongly connected to core MinEx CRC research programs. The approval process for MinEx CRC postgraduate student projects requires sign-off by a MinEx CRC Project Leader, Program Leader, Industry Co-supervisor(s), E&T Committee Coordinator and the CSO. All projects are tightly integrated with MinEx CRC's research agenda.

Student research is regularly featured in all forms of MinEx CRC reporting and is particularly significant in MinEx CRC meeting its milestones in the following areas:

- Project 1: Curtin University students are researching drilling fluid control and automation, cuttings transport, rock-bit interactions, impregnated diamond bits and down-hole percussive drilling. (Eu Lim Kean, Hing Hao Chan, Joao Victor Borges dos Santos, Maryam Abdollahi, Rui Huang, Siew Hong Chai, Snehal Jayakumar, Su Kwong Lee)
- Project 3: University of South Australia students are developing laser-induced breakdown spectroscopy (LIBS) analysis for real-time downhole chemical assay (Fernando Fontana) and utilising machine learning algorithms for automated interpretation of LIBS Spectra (Ivan Gutierrez Agramont).
- Project 4: Curtin University student Aruni Rajanayake is using geophysics for drilling trajectory control.
- Project 5: Curtin University PhD student Emad Al-Hemyari is using machine learning and artificial intelligence for processing, inversion and interpretation of distributed acoustic sensing (DAS) seismic data.
- Project 6: University of Western Australia students are developing methods for easier geological interpretation, automated multiscale 3D geological modelling and inversion and quantifying geological uncertainty from sparse exploration data (Lizzie Bruce, Mahtab Rashidifard, Nuwan Suriyaarachchi, Ranee Joshi).
- Program 3: Students at multiple MinEx CRC-affiliated universities are undertaking projects on signatures of alteration, basin analysis, thermochronology, geochronology, petrophysics, geophysics, biogeochemistry and microbiologyfor understanding metal fertility and prospectivity in frontier mineral exploration provinces (Alejandra Bedoya Meija, Andreas Bjork, Bianca Palombi, David Yanyi-Ankfur, Jie Yu, Joe Shifano, Justine Flahaut, Lucy Mathieson, Luke Tylkowski, Mosayeb KhademiNaina, Oliver Pring, Stacey Curtis, Yoli Wu, Zara Woolston, Zhufu Shao). UniSA PhD student Andres Sifuentes is studying the implications of MinEx CRC technologies for the social acceptance of mineral exploration.
- There are dedicated HDR sessions at MinEx CRC conferences and events and HDR students are provided financial support to travel and participate in these events. The November 2022 MinEx CRC Annual Conference was attended by 34 of 39 active students. The students attended an informal lunch and workshop on time management and positive strategic thinking facilitated by The Missing Think (Tracy Maxted), followed by a presentation on student engagement opportunities within AuScope (MinEx Affiliate) by AuScope CEO Tim Rawling. Every student presented a 'graphical abstract '-style poster at the conference and four students presented in the main speaking sessions. Students also attended the social events at the conference, which allowed them to network with industry and government representatives.

Ten students attended the May 2023 MinEx CRC Mid-Year Science Review in Adelaide and two late-stage PhD students presented their final research outcomes at the event. Several students were involved in the Project -specific commercialisation workshops held as part of this Mid-Year Science Review.

Seven videoconference sessions were held throughout the reporting period. Specific sessions were dedicated to discussing student involvement with MinEx CRC events, preparation for the 2022 Annual Conference, the 2023 Mid-year Science Review and the 2023 Mid-Year Postgraduate Day (held in July 2023 after this reporting period). A recently graduated MinEx CRC HDR student and three MinEx CRC Directors were invited to give presentations on the theme of 'Strategic Career Planning'.

Graduate destinations

Four of the seven postgraduate students who completed their projects within the reporting period are now employed with MinEx CRC Participants or Research Participants, as follows. Two graduates are employed in mineral exploration related roles with overseas companies and one Masters graduate has enrolled as a MinEx CRC PhD student: Alexander Simpson (PhD): Postdoctoral Researcher, British Geological Survey (UK).

- Angus Nixon (PhD): Postdoctoral Researcher, University of Adelaide.
- Darwinaji Subarkah (PhD): Postdoctoral Researcher, University of Adelaide.
- Fernando Fontana (PhD): Specialist Geologist LIBS and Data Analytics, Rio Tinto.
- Hing Hao Chan (Masters by research): Undertaking a PhD project at Curtin University with MinEx CRC Project 1.
- Mitchell Bockmann (PhD): Project Geologist, Geological Survey of South Australia.
- Sana Zulic (Masters by research): Consultant Geophysicist with Pragora (Serbia)



Completed MinEx CRC and University of Adelaide PhD student Alexander Simpson polishing drill core samples for detailed geological analysis.

MinEx CRC student pipeline

| Institution | | _ | 2019 |) | | | - | 2020 | i . | | | 2 | 021 | | | | 20 | 22 | | | | 202 | 23 | | | | 2024 | 4 | | | 3 | 2025 | - | | | | 2026 | 1 | | | 2 | 027 | | | 20 | 28 (t | o 30 | lune) | |
|-----------------------------------|-------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|------------|--------------|---------------|---------------|---------------|-------------|----------------------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|-------------|-------------|---------------|-------------|
| | Y1 students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS | YI students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS | Y1 students | Y2 students | Y3 students | Y3.5 students | VI studouts | support ti | V3 childents | V2 6 chudonte | Y3.5 Students | VI childrents | TT Students | Y2 students Y3 students | Y3.5 students | COMPLETIONS | Y1 students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS | Y1 students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS | Y1 students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS | Y1 students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS | Y1 students | Y2 students | Y3 students | Y3.5 students | COMPLETIONS |
| Australian National University | 1 | | | | | | ī | | | Ì | 1 | | 1 | | | t | | 3 | 1 | | | | T | 1 | - | | | | | T | | | | | | | | | | | | T | | | T | | | | 1 |
| Curtin University | 4 | | | | | 3 | 4 | | | | 3 | 3 | 41 | | - 2 | ũ. | 3 3 | 1 | 4 | 1 | 4 | á 3 | 3 | 4 | 3 | 4. | 4 | 3 | з | 1.7 | 3 | 4 | 4 | 3 | | | 3 | 4 | 4 | | | | 3 | 4 | | | | | з |
| University of Adelaide | 5 | | | | | | 5 | | | | 0 | | 5 | | 1 | | | 5 | 5 | 3 | z | L. | | 5 | 1 | 2 | 1 | 0 | ū | | 1 | Z | 1 | 0. | | | 1 | 2 | 1 | | | | 1 | 2 | | | | | 1 |
| University of Newcastle | | | | | | 3 | | | | | 1 | Е | | | | | 1 3 | | | | | d | 3 | | 1 | | | i | з | | 1 | | | 1 | | | 1 | | | | | | 1 | | | | | | 1 |
| University of New South Wales | | | | | | 1 | | | | | | į. | | | | | 1 | | | 3 | ı | | 4 | | | 1 | | | 1 | | | 1 | | | | | | 1 | | | | | | 1 | | | | | |
| University of South Australia | 2 | | | | | 3 | 2 | | | | 3 | 3 | 2 | | 3 | | i a | 2 | 2 | | 3 | 1 | 3 | 2 | 4 | 3 | 3 | 3 | 3 | | 4 | 3 | а | in. | | | 4 | 3 | - | | | | 4 | а | | | | | 4 |
| Unversity of Western Australia | 1 | 1.1 | | | | 1 | 1 | | | | 1 | 1 | 1 | | 3 | i s | 1 1 | 1 | 1 | 3 | 1 | 1 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | | | 1 | 1 | | | | | 1 | | | | | |
| CRC TOTAL | 13 | 0 | 0 | 0 | 0 | 11 | 13 | 0 | 0 | 0 | 8 | 11 | 13 | 0 0 |) 9 | | 8 1 | 1 1 | 3 | 0 1 | 1 1 | 9 8 | 11 | 1 13 | 9 | 11 | 9 | 8 | 24 | 0 | 9 | 11 | 9 | 32 | 0 | 0 | 9 | 11 | 41 | 0 | 0 | 0 | 9 | 52 | 0 | 0 | 0 | 0 (| 51 |

- Years refer to calendar years, except for 2028 which is to 30 June (end of MinEx CRC)

- Pipeline assumes 60 PhD student starts, each of which take 3.5 years to complete. The pipeline does not account for any Masters by Research starts, who will be expected to complete within 2 years.

- Numbers in each cell are respectively the numbers of first, second, third, fourth (to 3.5 years since commencement) and completed postgraduate students

- Colours indicate the progress of a year cohort.

- Non-completions are not accounted for within the pipeline. MinEx CRC aims to complete 50 students from 60 starts (83% completion rate).

- The pipeline allows for student commencements at each university as per the allocation based on the Participant universities overall involvement.

1.6 Intellectual Property Management

The following principles are applied in MinEx CRC under the guidance of a board sub-committee:

- IP resulting from MinEx CRC research is legally owned by MinEx CRC and beneficially owned according to project shares defined in individual Project Agreements for the five primary projects of MinEx.
- For the Project 6, where open-source software is being developed, the IP is legally and beneficially owned by MinEx CRC.
- Opportunity Fund projects recommended to the Board by the Science Advisory Committee (SAC) have IP legally and beneficially owned by MinEx CRC.
- IP rights can be sought by MinEx participants by expressing interest, using a MinEx proforma. Opportunities for commercialisation are highlighted at Project Review meetings and at SAC meetings.
- IP is to be diffused into the METS supplier sector as rapidly as possible as enhanced technology and/or services to mining companies, with the companies who sponsor MinEx CRC having preferential access.

MinEx currently holds:

- 88 properties across nine patent families. Of these, nine of which are Australian.
- 13 properties across three design families and three trade mark registrations. Of these, six are Australian.
- A total of 22 Licenses/Options/Assignments (LOAs) are active.
- Two Australian provisional patents are in preparation.

A list of Registered IP (patents, trademarks, designs) held by MinEx CRC is included in the MDQ and as Appendix C. Note that most Intellectual Property patents and families listed above originated in the DET CRC and were deeded to MinEx CRC on the termination of DET CRC in 2018.



Coiled tubing cuttings samples from the Delamerian National Drilling Initiative stored in 'chip trays' for future logging and analysis.

1.7 CRC Future Plans and Transition Arrangements

The MinEx CRC Board held a strategy session in May 2023 at which future plans and transition arrangements were discussed. The Board resolved to continue to keep legacy planning on the agenda for discussion, and action a plan with three years of the CRC remaining (i.e. in 2025).

Commercialisation of various outputs of MinEx CRC continued in the past year. The success of commercialisation will help determine the future plans and legacy of MinEx.

In the past year commercial consideration has been given to the following projects:

- Project 1 (Fluids), with the cooperation of Curtin University
- Project OP7.1 (Visualisation) where four expressions of interest for commercialisation were received.
- Projects 3 and 4 (LIBS and EM sensing) where patent applications commenced with a view to commercialisation.

1.8 Financial Management

MinEx CRC commenced operations on 12 April 2018. The financial tables provided below compare the current FY23, with all previous years back to FY19 (includes the period from 12 April 18 to 30 June 18).

| REF | TITLE |
|---------|--|
| Table 1 | Revenue and Expenditure (by Financial Year to date Including Cumulative Total) |
| Table 2 | Statement of Financial Position (by Financial Year to date) |
| Table 3 | Cumulative Cash Report (by Financial Year to date Including Cumulative Total) |

The following key points provide an overview of the financial performance of the CRC during FY23.

Cash Balance and Surplus

The CRC had a deficit for FY23 of \$2.2M, with the CRC Life to date restricted surplus reducing to \$10.3M. With some Participant funds being received in advance in FY19 and FY20, the CRC generated a significant surplus, which will gradually reduce to Nil over the 10 year life of the CRC. The cash balance at 30 June 23 was \$10.7M compared to 30 June 22 of \$13.1M and 30 June 21 \$14.8M. All of these funds are committed to future research programs, drilling campaigns, education and training activities and management of operational activities.

The NDI drilling campaigns which commenced in September 2020, and CT Drilling field trials which commenced in May 2021 have reduced the cash balance by approximately \$8.6M in FY21 and \$4.6M in FY22. During FY23 the NDI drilling campaigns have reduced the cash balance by a further \$6.4M.

Participant Contributions

Revenue from Participant & Affiliate contributions was \$6.6M for FY23 (\$5.8M in FY22 and \$7.2M in FY21). This exceeded the Commonwealth Agreement Budget in FY23 by approximately \$4.4M, primarily due to additional contributions received/receivable for the year compared to the Agreement.

Research Projects

Phase 1 of the research projects came to completion in December 2021 with Phase 2 projects commencing January 2022 and now half-way through at the end of FY23. Payment to researchers is made quarterly in arrears based on actual expenditure. Project expenses were \$5.0M for FY23 (\$5.8M in FY22 and \$6.2M in FY21).

Interest Income

Cash balances are being invested in a mixture of short- and medium-term cash deposits appropriate for cash flow requirements. No interest income was included in the original Commonwealth Agreement Budget. Total interest income earned to date is \$972.8K. Interest rates dropped over the last two of years but have risen substantially over FY23 and are currently stable.

CRC Contributions

Cash payments from the Commonwealth were \$5.5M (GST exclusive) in the period (\$5.5M for FY22 and \$5.8M for FY21). Payments from the Commonwealth are paid quarterly in arrears, following completion of the quarterly CRC Report.

National Drilling Initiative (NDI) Campaigns

The field trials with the CT Rig commenced in August 2021 at Mawson Lakes and the first of the NDI drilling campaigns with the CT Rig followed in October 2021. The GSSA Delamerian North campaign was completed during FY22 with drilling at the GSSA Delamerian South campaign being finalised early during FY23.

In addition to these NDI Campaigns, CT drilling was successfully undertaken in Queensland for Anglo American in H2 of 2022. In March 2023 CT drilling commenced for the NSW Delamerian Margins Campaign and this continued through to completion at the end of the financial year.

| Table 1 - Revenue & Expenditure (\$'000) | FY23 | FY22 | FY21 | FY20 | FY19 | Cumulative Total |
|--|-----------|-----------|-----------|----------|----------|---------------------|
| Revenue | | | | | | |
| Commonwealth Funding | 5,500.0 | 5,500.0 | 5,798.5 | 6,597.0 | 2,729.5 | 26,125.0 |
| Other Government Grants | 28.0 | - | - | - | - | 28.0 |
| Participant Contributions | 6,421.1 | 5,600.0 | 7,023.0 | 4,811.8 | 12,067.5 | 35,923.4 |
| Affiliates Contributions | 215.0 | 210.0 | 185.1 | 285.0 | 150.0 | 1,045.1 |
| DET CRC Unspent Participant Contributions | - | - | - | - | 113.6 | 113.6 |
| Non-financial asset acquired for Nil Consideration | - | - | - | 850.0 | - | 850.0 |
| Interest Income | 365.3 | 70.1 | 112.9 | 300.5 | 124.0 | 972.8 |
| Royalty Income | 127.4 | 52.1 | 34.1 | - | - | 213.6 |
| Other Income | 18.1 | 79.8 | 9.6 | 122.2 | 30.8 | 260.5 |
| Total Revenue | 12,674.9 | 11,512.0 | 13,163.2 | 12,966.5 | 15,215.4 | 65,532.0 |
| | | | | | | |
| Expenditure | | | | | | |
| Research Program Expenditure | | | | | | |
| - Program 1 | 1,871.9 | 1,905.5 | 2,576.7 | 2,121.4 | 486.1 | 8,961.6 |
| - Program 2 | 1,361.1 | 1,292.8 | 1,610.1 | 1,524.6 | 544.8 | 6,333.4 |
| - Program 3 | 6,866.8 | 5,686.0 | 10,405.2 | 1,859.8 | 653.5 | 25,471.3 |
| - Opportunity Fund & Other Projects | 759.8 | 580.2 | 204.8 | - | - | 1,544.8 |
| Total Research Program Expenditure | 10,859.6 | 9,464.5 | 14,796.8 | 5,505.8 | 1,684.4 | 42,311.1 |
| | | | | | | |
| Education & Training | 575.4 | 432.3 | 504.4 | 384.5 | 200.0 | 2,096.6 |
| Management Expenses | 841.3 | 717.2 | 418.2 | 492.3 | 503.8 | 2,972.8 |
| Royalty Expense | 85.5 | 28.7 | 22.0 | - | - | 136.2 |
| Salaries & Wages - Drill Crew | 1,149.1 | 987.8 | 97.2 | - | - | 2,234.1 |
| Salaries & Wages - Head Office (incl Directors Fees) | 1,390.6 | 1,049.8 | 1,046.7 | 996.9 | 1,005.3 | 5,489.3 |
| | 4,041.9 | 3,215.8 | 2,088.5 | 1,873.7 | 1,709.1 | 12,929.0 |
| Total Expenditure | 14,901.5 | 12,680.3 | 16,885.3 | 7,379.5 | 3,393.5 | 55,240.1 |
| | | | | | | |
| Restricted (Deficit)/ Surplus | (2,226.6) | (1,168.3) | (3,722.1) | 5,587.0 | 11,821.9 | 10,291.9 |

| Table 2 - Statement of Financial Position (\$'000) | 30-Jun-23 | 30-Jun-22 | 30-Jun-21 | 30-Jun-20 | 30-Jun-1 9 |
|--|-----------|-----------|-----------|-----------|-------------------|
| Assets | | | | | |
| Cash at Bank | 10,728.5 | 13,148.8 | 14,794.8 | 18,167.3 | 13,688.1 |
| Trade Receivables | 271.6 | 596.2 | 369.8 | - | 255.0 |
| Other Receivables | 632.9 | 395.2 | 442.2 | 396.6 | 166.4 |
| Prepayments & Accrued Income | 267.5 | 135.7 | 101.8 | 84.3 | 100.4 |
| Mining Exploration Bonds | 130.0 | - | 39.9 | - | - |
| Property Plant & Equipmnent | 1,172.5 | 962.2 | 1,251.6 | 1,031.2 | 9.2 |
| Total Assets | 13,203.0 | 15,238.1 | 17,000.1 | 19,679.4 | 14,219.1 |
| | | | | | |
| Liabilities | | | | | |
| Trade Payables & Accruals | 2,634.0 | 2,544.4 | 3,081.2 | 2,205.6 | 2,366.2 |
| Employee Provisions | 271.3 | 165.0 | 97.8 | 59.7 | 21.3 |
| Lease Liability - Premises | 5.8 | 10.2 | 134.3 | 5.2 | 9.7 |
| Total Liabilities | 2,911.1 | 2,719.6 | 3,313.3 | 2,270.5 | 2,397.2 |
| | | | | | |
| Net Assets | 10,291.9 | 12,518.5 | 13,686.8 | 17,408.9 | 11,821.9 |
| | | | | | |
| Current Year Restricted (Deficit)/ Surplus | (2,226.6) | (1,168.3) | (3,722.1) | 5,587.0 | 11,821.9 |
| Retained Restricted Surplus | 12,518.5 | 13,686.8 | 17,408.9 | 11,821.9 | - |
| | | | | | |
| Equity | 10,291.9 | 12,518.5 | 13,686.8 | 17,408.9 | 11,821.9 |

| Table 3 - Cumulative Cash Report (\$'000) | FY23 | FY22 | FY21 | FY20 | FY19 | Cumulative Total |
|--|------------|------------|------------|--------------------|-----------|---------------------|
| Cash flows from operating activities (inclusive of GST where applicable) | | | | | | |
| Government grants | 6,050.0 | 6,050.0 | 6,378.4 | 7,256.7 | 3,002.4 | 28,737.5 |
| Participant contributions | 7,546.2 | 6,170.0 | 7,551.0 | 5,754.6 | 13,097.2 | 40,119.0 |
| Other income | 90.0 | 54.0 | 50.0 | 63.9 | 131.4 | 389.3 |
| Royalties received | 104.1 | 32.3 | 4.7 | - | - | 141.1 |
| Interest received | 217.5 | 51.8 | 142.4 | 303.1 | 74.5 | 789.3 |
| Interest paid | (1.0) | (8.1) | (1.6) | (1.0) | (1.4) | (13.1) |
| Royalties paid | (39.3) | (16.9) | (2.6) | - | - | (58.8) |
| Payments to suppliers and employees | (15,976.7) | (13,846.1) | (17,259.9) | (8 <i>,</i> 656.4) | (2,611.9) | (58 <i>,</i> 351.0) |
| | | | | | | |
| Net cash (used in)/ provided by operating activities | (2,009.2) | (1,513.0) | (3,137.6) | 4,720.9 | 13,692.2 | 11,753.3 |
| | | | | | | |
| Cash flows from investing activities | | | | | | |
| Payments for plant and equipment | (336.8) | (18.1) | (215.0) | (237.0) | - | (806.9) |
| Payments for motor vehicles | (69.1) | - | - | - | - | (69.1) |
| | | | | | | |
| Net cash used in investing activities | (405.9) | (18.1) | (215.0) | (237.0) | - | (876.0) |
| | | | | | | |
| Cash flows from financing activities | | | | | | |
| Repayment of lease liability | (5.2) | (114.9) | (19.9) | (4.7) | (4.1) | (148.8) |
| | | | | | | |
| Net cash used in financing activities | (5.2) | (114.9) | (19.9) | (4.7) | (4.1) | (148.8) |
| | | | | | | |
| Net change in cash and cash equivalents | (2,420.3) | (1,646.0) | (3,372.5) | 4,479.2 | 13,688.1 | 10,728.5 |
| Cash and cash equivalents at the beginning of the year | 13,148.8 | 14,794.8 | 18,167.3 | 13,688.1 | - | - |
| Cash and cash equivalents at the end of the year | 10,728.5 | 13,148.8 | 14,794.8 | 18,167.3 | 13,688.1 | 10,728.5 |



Appendix A 2022 Year in Review





AusIndustry Cooperative Research

Cooperative Research Centres Program

MINEX CRC 2022 YEAR IN REVIEW

CHEAPER, FASTER, SAFER, CLEANER MINING TECHNOLOGY

KEY NUMBERS:

ZERO

Reportable WHSE incidents

20

peer-reviewed scientific publications

35

Postgraduate students enrolled

57-433%

pro-female gender split on MinEx CRC Board of Directors (excluding CEO)

318/318 ONE National Drilling

Phase 1 quarterly milestones met

14/14

Commonwealth Milestones met

гмо

Postgraduate

completions

drilled by the CT drilling

platform in total

4652M drilled by the CT drilling platform during the Delamerian NDI

> Campaign **1976**M

Initiative (NDI) Campaign

completed in the

South Australia

Delamerian region of

of rotary/mud/diamond meters drilled during **Delamerian NDI** Campaign

RESEARCH FOCUS:

MinEx CRC remains focused on delivering 1) cheaper, faster, safer, cleaner drilling technologies, 2) in-field sensing and data science to enable informed decisions while drilling, and 3) precompetitive geoscience data to de-risk exploration in frontier mineral provinces, delivered by the National Drilling Initiative.



Participants Sponsors.

Affiliate Sponsors.

ADVANCING **TECHNOLOGY:**

Program 1: Drilling

- The first-of-a-kind discreet impact experimental setup for percussion drilling ("Woody") is commissioned and producing experimental data which will provide insights into the physical mechanisms controlling the anecdotal "sweet spot" of percussion drilling.
- · MinEx CRC-designed measurement, monitoring and control systems ("DTrol") have been installed on two drill rigs, a Reverse Circulation percussion drill rig and a Diamond drill rig and will be tested in a real-world drilling environment during the second half of 2022.
- The prototype fluid management system for Coiled Tubing drilling, CTiFluid, has been incorporated • Preliminary laboratory tests indicate that the into the Hydraulic Processing System for Coiled laboratory prototype of the MinEx CRC swept EM Tubing drilling and deployed in drilling trials at tool is highly sensitive and suitable for downhole Mawson Lakes and Kapunda and the Delamerian geophysical logging applications. National Drilling Initiative (NDI) campaign.
- The MinEx CRC Coiled Tubing drilling platform completed 19 drill holes for a total of 5211m during the reporting period - almost tripling the total number of meters drilled on the CT platform.





MinEx CRC CT drill rig on site during the Delamerian NDI Campaign.



Program 2: Data From Drilling

- The MinEx CRC prototype LIBS downhole assay tool, including a new design of front-end optics and two independent spectrometers, has been built and deployed in laboratory experiments. Experiments to assess the performance of LIBS on water-saturated samples and samples with centimetre-scale surface roughness are underway.
- The MinEx CRC borehole total counts gamma tool (Gamma GeoSub) was deployed in a CT drill hole. Multiple data streams (gamma, three component accelerations, gyro hole orientation and temperature) were successfully transmitted to the surface from the bottom of the hole.
- An optic fibre distributed acoustic sensor (DAS) was fitted inside the Coiled Tubing for the CT drilling rig and tested using a surface source and the drill bit (and hammer) as a source. The data show great promise for identifying geological features and delivering a seismic velocity profile from the drilled formations.
- Conducted 3D seismic surveys using optic fibre distributed acoustic sensors (DAS) as 'landstreamers' at the BHP Bonobo prospect in the Pilbara. The data were guick and cheap to acquire and provide valuable constraints on rock properties and depth to basement.
- Researchers are implementing an online selfservice platform to access and run the 3D geological modelling and inversion software tools developed by MinEx CRC.



3D model of the Hamersley region, Western Australia, showing the Mt Brockman and Mt Turner synclines with Rocklea Dome. Adapted from Lindsay et al 2022 Geosci. Frontiers.

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Program 3: National Drilling Initiative

- Post-drilling analyses of drill cuttings and drill core from the East Tennant NDI campaign have confirmed that the basement rocks in the East Tennant NDI campaign area are of comparable age and characteristics to the rocks which host the well-known copper-gold Tennant Creek mineral deposits.
- Six rotary mud/diamond drill holes (1976m) and 17 Coiled Tubing drill holes (4652m) were completed between October 2021 and April 2022 as part of the Delamerian National Drilling Initiative (NDI) campaign in eastern South Australia.
- Researchers have developed a machine learning workflow for the objective classification of drill hole portable XRF geochemical data into geological units.
- Researchers have implemented "Occam" techniques to improve airborne electromagnetic (EM) inversions so that the output is more likely to honour stratigraphic layering and the location of paleochannels.
- The continent-scale set of argon-argon thermochronological data (collaborating with the National Argon Map initiative) continues to grow with over 90 analyses contributed by MinEx CRC, including samples from the East Tennant NDI campaign.
- Supported development of in-situ Re-Os and Lu-Hf geochronological techniques suited to dating minerals formed during mineralisation (e.g. sulphides, carbonates, phosphates and garnet).
- Progressed our understanding of Cu-isotope fractionation in mineral systems with parallel studies of modern-day sites (volcanos and seafloor hydrothermal vents) and ancient volcanic sequences (e.g. the 1590Ma Gawler Range Volcanics) and mineralising systems, including the Cambro-Ordovician Kanmantoo Cu deposit in the Adelaide Hills and the Tennant Creek Cu-Au mineral system.

MinEx CRC National Drilling In



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Delamerian margin area showing completed drilling in South Australia (red dots), while in early 2023 MinEx CRC will be conducting drilling on the NSW side. Image shows magnetics coloured by gravity (Geoscience Australia national coverages).



East Tennant and Carrera sub-basin drilling (red dots) shown in regional context with magnetics background coloured by radiometrics (Geoscience Australia national coverages).

132 press articles generated

27K website visitors

B.1K+ YouTube views

RESEARCH ENGAGEMENT:

- Field trials of the MinEx CRC CT drilling platform (including the drill rig and hydraulic processing system) were conducted at the Kapunda field site of Affiliate EnviroCopper.
- MinEx CRC-designed measurement, monitoring and control systems ("DTrol") have been installed on two drill rigs, a Reverse Circulation percussion drill rig and a Diamond drill rig, operated by MinEx CRC Participant McKay Drilling.
- MinEx CRC maintained its relationship with OMNI GeoX to coordinate and manage aspects of the Delamerian South NDI campaign.
- Participant Imdex Limited provided significant in-kind contributions of people and equipment to research projects and logging equipment for the NDI drilling program. The equipment was a valuable aid to the project and provided Imdex with important feedback on the use and development of recently released products.
- MinEx CRC's seismic research project conducted field trials at Anglo American and BHP field sites.
- Cooperation is ongoing with European-based METS companies Sandvik, Epiroc, LKAB Wassara and Sercel. Staff from the Anglo American London office have become involved with the pull-through of MinEx CRC CT drilling technology, which has prompted discussions with international companies interested in the commercial manufacture of the CT platform. Chilean-based drilling company Geotec Boyles remains an active participant in Project 1, with field trials in South America being planned for the calendar year 2023.



COMMUNICATIONS:

- Three quarterly episodes of the MinEx CRC vNews were published on MinEx CRC TV (the MinEx CRC Annual Conference serves as the Q4 update for researchers and sponsors).
- Eight videos were published on MinEx CRC TV, with over 3.1K views in total.
- One promotional video was released on the CT Kapunda Field Trials featuring key researchers and community leaders.
- 132 press articles generated.
- 27K visitors to the MinEx CRC website, with 62K page views in total.

EQUITY, DIVERSITY, AND INCLUSION (EDI):

MinEx CRC is committed to growing and supporting an equitable, diverse, and inclusive environment where everyone feels safe, valued, supported, and treated fairly, with dignity and respect. MinEx CRC undertook the following EDI actions during the reporting period:

- The MinEx CRC 'Code of Conduct' was established to ensure a collegiate, inclusive and encouraging atmosphere is maintained when undertaking the work of the CRC.
- The MinEx CRC EDI Committee and Chairperson appointed.
- The MinEx CRC EDI Action Plan and Policy were both finalised and endorsed by management. These documents are publicly available on the MinEx CRC EDI webpage.
- The MinEx CRC Board (excluding the CEO) comprises seven members, 57% female and 43% male.
- Research leads for the nine primary programs are 78% male and 22% female.

SPONSORS

Majors, METs & Survey Participants



Research Participants & Affiliates



REVENUE & EXPENDITURE

| Revenue (\$'000) | FY22 | FY21 | FY20 | FY19 | Total |
|--|----------|----------|----------|----------|----------|
| Commonwealth Funding | 5,500.0 | 5,798.5 | 6,597.0 | 2,729.5 | 20,625.0 |
| Participant Contributions | 5,600.0 | 7,023.0 | 4,811.8 | 12,067.5 | 29,502.3 |
| Affiliates Contributions | 210.0 | 185.1 | 285.0 | 150.0 | 830.1 |
| DET CRC Unspent Participant Contributions | - | - | - | 113.6 | 113.6 |
| Non-financial asset acquired for Nil Consideration | - | - | 850.0 | - | 850.0 |
| Interest Income | 70.1 | 112.9 | 300.5 | 124.0 | 607.5 |
| Royalty Income | 52.1 | 34.1 | - | - | 86.2 |
| Other Income | 79.8 | 9.6 | 122.2 | 30.8 | 242.4 |
| Total Revenue | 11,512.0 | 13,163.2 | 12,966.5 | 15,215.4 | 52,857.1 |

Expenditure (\$'000)

| 12,680.3 | 10,085.3 | 7,379.5 | 3,393.5 | 40,338.0 |
|----------|--|--|--|--|
| 40.000.0 | 16 005 0 | 7 2 7 0 5 | 2 202 5 | (0 220 G |
| 3,215.8 | 2,088.5 | 1,873.7 | 1,709.1 | 8,887.1 |
| 1,049.8 | 1,046.7 | 996.9 | 1,005.3 | 4,098.7 |
| 987.8 | 97.2 | - | - | 1,085.0 |
| 745.9 | 440.2 | 492.3 | 503.8 | 2,182.2 |
| 432.3 | 504.4 | 384.5 | 200.0 | 1,521.2 |
| 9,464.5 | 14,796.8 | 5,505.8 | 1,684.4 | 31,451.5 |
| 580.2 | 204.8 | - | - | 785.0 |
| 5,686.0 | 10,405.2 | 1,859.8 | 653.5 | 18,604.5 |
| 1,292.8 | 1,610.1 | 1,524.6 | 544.8 | 4,972.3 |
| 1,905.5 | 2,576.7 | 2,121.4 | 486.1 | 7,089.7 |
| | 1,905.5 1,292.8 5,686.0 580.2 9,464.5 432.3 745.9 987.8 1,049.8 3,215.8 | 1,905.5 2,576.7 1,292.8 1,610.1 5,686.0 10,405.2 580.2 204.8 9,464.5 14,796.8 432.3 504.4 745.9 440.2 987.8 97.2 1,049.8 1,046.7 3,215.8 2,088.5 | 1,905.5 2,576.7 2,121.4 1,292.8 1,610.1 1,524.6 5,686.0 10,405.2 1,859.8 580.2 204.8 - 9,464.5 14,796.8 5,505.8 432.3 504.4 384.5 745.9 440.2 492.3 987.8 97.2 - 1,049.8 1,046.7 996.9 3,215.8 2,088.5 1,873.7 | 1,905.5 2,576.7 2,121.4 486.1 1,292.8 1,610.1 1,524.6 544.8 5,686.0 10,405.2 1,859.8 653.5 580.2 204.8 - - 9,464.5 14,796.8 5,505.8 1,684.4 432.3 504.4 384.5 200.0 745.9 440.2 492.3 503.8 987.8 97.2 - - 1,049.8 1,046.7 996.9 1,005.3 3,215.8 2,088.5 1,873.7 1,709.1 |

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Australian Government Department of Industry, Science and Resources

AusIndustry Cooperative Research Centres Program



Appendix B Student Register MinEx CRC Limited 26 Dick Perry Avenue, Kensington, WA, 6151 PO Box 1130, Bentley, WA, 6102, Australia admin@minexcrc.com.au



Postgraduate students

| # | Student | University | Supervisor | Industry co- supervisor | Degree | Project title | Project | Start Date | Finish date | Date registered |
|---|--------------------------------------|------------|--------------|---|---------|--|---------|------------|-------------|--------------------|
| 1 | Alejandra Bedoya Meija | UoA | Stijn Glorie | David Kelsey (GSWA) | PhD | Thermochronology of the margins of 'The Gap', Western Australia | 7 | 20/12/2021 | 19/12/2024 | 27/01/2022 |
| 2 | Alexander Simpson | UoA | Stijn Glorie | Anthony Reid (GSSA) | PhD | Thermochronological and geochemical footprints of fluid alteration, recorded in apatite | | 15/03/2019 | 15/03/2022 | 13/02/2019 |
| 3 | Alexander De Vries Van Leeuwen | UniSA | Tom Raimondo | Rian Dutch (GSSA), Joel Fitzherbert (GSNSW) | PhD | Timing, duration and conditions of metamorphism and crustal melting in the Curnamona Province | 7 | 26/03/2018 | 17/04/2022 | 16/09/2019 |
| 4 | Anatolii Pakhomenko | Curtin | Andrej Bona | Ashley Grant (BHP) | Masters | Machine learning to invert surface-wave data | 5 | 18/05/2020 | 18/05/2022 | 19/06/2020 |
| 5 | Andreas Bjork | UniSA | David Giles | James Austin (CSIRO) | PhD | Application of the multi-sensor core logger for petrophysical analysis and geophysical modelling | 7 | 18/04/2022 | 17/04/2025 | 2/06/2022 |
| 6 | Angus Nixon | UoA | Stijn Glorie | Geoff Fraser (GA) | PhD | Thermochronological Evolution of the McArthur Basin and Surrounding Basement Areas | 7 | 19/03/2018 | 1/01/2022 | 13/02/2019 |
| 7 | Aruni Rajanayake | Curtin | Brett Harris | Fiona Best (South32) | PhD | Innovative geophysics for drilling trajectory control | 4 | 01/02/2021 | 1/02/2021 | 16/02/2021 |
| 8 | Bianca Palombi | UoN | Brett Neilan | Chris Folkes (GSNSW), Nathan Reid (CSIRO) | PhD | Microbial diversity and their genetic basis for heavy metal resistance in regolith | 7 | 1/03/2022 | 1/03/2025 | 23/03/2022 |
| 9 | Darwinaji Subarkah | UoA | Alan Collins | Amber Jarrett (NTGS), Geoff Fraser (GA) | PhD | Shale geochemistry and geochronology of the greater McArthur Basin | 7 | 2/06/2019 | 1/06/2022 | 3/06/2019 |



| # | Student | University | Supervisor | Industry co- supervisor | Degree | Project title | Project | Start Date | Finish date | Date registered |
|----|----------------------------------|-------------------------------------|-------------------|---|---------|---|---------|------------|-------------|--------------------|
| 10 | Eu Lim Kean | Curtin | Masood Mostofi | Alton Grabsch (CSIRO) | PhD | Non-Newtonian fluid flow in naturally fractured rocks with application in fluid loss control | 1 | 1/04/2022 | 1/04/2024 | 22/08/2022 |
| 11 | Hing Hao Chan - PhD | Curtin | Masood Mostofi | Yevhen Kovalyshen (CSIRO) | PhD | Effect of wear on drilling response of an impregnated diamond bit | 1 | 1/09/2022 | 1/09/2026 | 2/09/2022 |
| 12 | Ivan Gutierrez Agramont | University of South Australia | Caroline Tiddy | Neil Francis, Yulia Uvarova (CSIRO) | PhD | Generating synthetic data for training predictive spectroscopic models | 3 | 12/07/2021 | 12/07/2024 | 12/07/2021 |
| 13 | Jie Yu | University of Adelaide | Martin Hand | Rian Dutch (GSSA) | PhD | Tectonic systems and IOCG mineralisation in the Gawler Craton | 7 | 15/10/2018 | 15/10/2021 | 26/03/2019 |
| 14 | Joao Victor Borges dos Santos | Curtin University | Thomas Richard | Bevan Eagle (McKay Drilling) | PhD | Experimental study of down-hole percussive drilling | 1 | 30/07/2019 | 30/07/2022 | 10/01/2020 |
| 15 | Joe Shifano | University of New South Wales | David Cohen | John Greenfield (GSNSW) | PhD | Regional biogeochemical mapping (and associated regolith studies) of the Cobar Basin for mineral exploration at regional to local scales | 7 | 1/03/2019 | 1/07/2021 | 18/04/2019 |
| 16 | Justine Flahaut | UniSA | Justin Payne | Claire Wade (GSSA) | PhD | New approaches for rapid analysis and tracing of fluids and their ligands in regional mineral systems | 7 | 14/11/2022 | 14/11/2025 | 7/12/2022 |
| 17 | Lizzie Bruce | UWA | Mark Jessell | Richard Chopping (GSWA) | Masters | Tomofast-x grav-mag inversion to compare the upper crustal structure of Archean and Paleoproterozoic greenstone belts | 6 | 23/02/2023 | 29/09/2023 | 13/02/2023 |
| 18 | Lucy Mathieson | Curtin University | Chris Kirkland | Klaus Gessner (GSWA), Anthony Reid (GSSA) | PhD | Mapping radiogenic Pb loss in space and time: a new tool to track fluid rock interaction | 7 | 7/03/2022 | 6/03/2026 | 21/03/2022 |
| 19 | Luke Tylkowski | University of South Australia | Caroline Tiddy | Rob Duncan (GSV), Rob Thorn (CSIRO) | PhD | Resistate indicator minerals as an exploration tool for orogenic gold mineralisation: a case study from the Murray Basin, southeastern Australia | 7 | 1/3/2021 | 1/03/2024 | 4/03/2021 |

| # | Student | University | Supervisor | Industry co- supervisor | Degree | Project title | Project | Start Date | Finish date | Date registered |
|----|---------------------------|---------------------------------------|-------------------|--|--------|---|---------|------------|-------------|--------------------|
| 20 | Mahtab Rashidifard | University of Western Australia | Mark Lindsay | Steven Micklethwaite (Anglo American), Richard Chopping (GSWA) | PhD | Constraining regional geophysics with sparse high-resolution data | 6 | 21/10/2019 | 20/10/2022 | 3/12/2019 |
| 21 | Maryam Abdollahi | Curtin | Masood Mostofi | Yevhen Kovalyshen (CSIRO) | PhD | Design and evaluation of shape memory polymers composite (SMPC) to control lost circulation of water-based mud | 1 | 2/05/2023 | 2/05/2026 | 13/06/2023 |
| 22 | Mosayeb Khademi Zahedi | University of South Australia | Dave Giles | Teagan Blaikie (CSIRO) | PhD | Linking geophysics and geology through borehole data | 5 | 8/2/2021 | 8/02/2024 | 18/02/2021 |
| 23 | Naina | Australian National University | Marnie Forster | Anthony Reid (GSSA), Geoff Fraser (GA) | PhD | Cambro-Ordovician magmatism and deformation at the eastern margin of Gondwana, South Australia: Insights into tectonic processes and mineral potential | 7 | 29/03/2019 | 29/03/2022 | 6/05/2019 |
| 24 | Nuwan Suriyaarachchi | University of Western Australia | Mark Jessell | Lachlan Hennessey (Anglo American), Richard Chopping (GSWA) | PhD | Integrated passive seismic/EM characterisation of cover as constraints on drilling | 6 | 21/10/2019 | 20/10/2022 | 3/12/2019 |
| 25 | Oliver Pring | UoA | Lucy McGee | Phillip Blevin (GSNSW) | PhD | Tracing the movement of metals through the mantle and crust using Cu isotopes | 7 | 14/03/2022 | 14/09/2025 | 24/10/2022 |
| 26 | Ranee Joshi | University of Western Australia | Mark Jessell | Tim Ivanic (GSWA) | PhD | Multi-scale 3D geological modelling of the Yalgoo-Singleton Greenstone Belt using the Loop Platform | 6 | 22/01/2019 | 22/01/2022 | 26/02/2019 |
| 27 | Richard Hill | University of Tasmania | Rob Scott | David De Tata (representing consortium of SEG, Encounter Resources, Middle Island Resources and Inca Minerals) | PhD | Exploring the East Tennant region: Unravelling the crustal architecture, tectonic evolution and mineral systems potential of an undercover Proterozoic terrane through the integrated use of geophysics, drill hole data and machine learning/geodata analysis techniques | Company | 2/08/2021 | 5/08/2024 | 13/09/2021 |

| # | Student | University | Supervisor | Industry co- supervisor | Degree | Project title | Project | Start Date | Finish date | Date registered |
|----|------------------------|-------------------------------------|-------------------|--|---------|---|---------|------------|-------------|--------------------|
| 28 | Rui Huang (Eric) | Curtin University | Masood Mostofi | Yevhen Kovalyshen (CSIRO) | PhD | Fundamentals of rock fragmentation of impregnated diamond bits | 1 | 1/04/2020 | 1/12/2023 | 22/06/2020 |
| 29 | Ruiqi Zheng | University of Adelaide | Juraj Farkas | Erick Ramanaidou (CSIRO) | PhD | Geological and geochemical constraints on the origin and diagenetic history of Neoproterozoic Breamar ironstones (SA) based on new metal isotope (Fe, Cr) and REE proxies | Company | 31/01/2022 | 30/01/2025 | 25/03/2022 |
| 30 | Siew Hong Chai | Curtin University | Masood Mostofi | Phillip Fawell (CSIRO) | Masters | Drilling fluid automation | 1 | 1/07/2019 | 31/07/2021 | 25/10/2019 |
| 31 | Snehal Jayakumar | Curtin University | Masood Mostofi | Yevhen Kovalyshen (CSIRO) | PhD | Cutting transport in RC drilling using compressible fluids | 1 | 15/06/2020 | 15/06/2023 | 7/09/2020 |
| 32 | Stacey Curtis | University of South Australia | Justin Payne | Mark Pawley (GSWA) | PhD | Integrated framework for the magmatic evolution of the greater Delamerian Orogen | 7 | 10/02/2020 | 9/02/2023 | 1/04/2020 |
| 33 | Su (Joel) Kwong Lee | Curtin | Thomas Richard | Yevhen Kovalyshen (CSIRO) | Masters | Experimental setup for a single diamond cutter drill test | 1 | 1/06/2022 | 1/06/2024 | 22/08/2022 |
| 34 | Travis Batch | University of South Australia | Caroline Tiddy | Tony Belperio, Glen Little (Demetallica) | PhD | Magnetite and monazite chemistry for iron oxide-copper-gold exploration | Company | 30/09/2021 | 30/09/2024 | 5/10/2021 |
| 35 | Yoli Wu | ANU | Marnie Foster | David Kelsey (GSWA) | Masters | Application of argon geochronology to constrain shear zone movement and exhumation of the northern and eastern margins of the West Australian craton | 7 | 30/09/2022 | 30/09/2024 | 24/10/2022 |
| 36 | Zara Woolston | University of Adelaide | Juraj Farkas | Anna Petts, Alicia Caruso (GSSA), Phil Gilmore, John Greenfield (GSNSW) | PhD | Tracing subsurface ore deposits through the isotope analysis of regolith/cover in Australia: Coupled Cu and S isotope approach applied to a rock-soil-water- plant system | 7 | 1/3/2021 | 1/03/2025 | 7/04/2021 |

| # | Student | University | Supervisor | Industry co- supervisor | Degree | Project title | Project | Start Date | Finish date | Date registered |
|----|------------|---------------------------|--------------|----------------------------|--------|--|---------|------------|-------------|--------------------|
| 37 | Zhufu Shao | University of Adelaide | Juraj Farkas | Charles Verdel (NTGS) | PhD | Novel isotope techniques for basin exploration: In-situ dating and metal isotope analysis of glauconite/apatite from the Georgina Basin | 7 | 29/11/2021 | 29/11/2024 | 21/02/2022 |

Completed students

| # | Student | University | Supervisor | Co-supervisors | Industry co- supervisor | Degree | Project title | Finish date | Graduation Destination |
|---|-----------------------|-------------------------------------|-------------------|--|---|---------|--|-------------|--|
| 1 | Angus Nixon | University of Adelaide | Stijn Glorie | Alan Collins (UoA) | Geoff Fraser (GA) | PhD | Low-temperature thermal evolution of the McArthur Basin and adjacent Proterozoic orogens | 15/06/2022 | Postdoctoral Researcher, University of Adelaide |
| 2 | Hing Hao Chan | Curtin University | Masood Mostofi | Thomas Richard (Curtin) | Aaron Earl (McKay Drilling) | Masters | Experimental investigation on fundamentals of rock-bit interactions using impregnated diamond bits | 1/07/2022 | PhD with Masood at Curtin University |
| 3 | Sana Zulic | Curtin University | Roman Pevzner | Andrej Bona, Konstantin Tertyshnikov (Curtin) | Sara Jakica (GSWA) | Masters | Advanced Borehole Seismic Imaging Techniques for Mineral Exploration | 9/12/2022 | Consultant Geophysicist at Pragora (Serbia) |
| 4 | Darwinaji Subarkah | University of Adelaide | Alan Collins | Juraj Farkas, Morgan Blades (UoA) | Amber Jarrett (NTGS), Geoff Fraser (GA) | PhD | The sedimentary geochemistry and geochronology of the Proterozoic greater McArthur Basin, northern Australia | 14/03/2023 | Postdoctoral Researcher, University of Adelaide |
| 5 | Mitchell Bockmann | University of Adelaide | Martin Hand | Laura Morrissey, Justin Payne (UniSA) | Claire Wade (GSSA) | PhD | The early Mesoproterozoic tectonic and thermal evolution of the eastern Gawler Craton: implications for mineral systems in eastern Proterozoic Australia | 12/04/2023 | Project Geologist, Geological Survey of South Australia |
| 6 | Alexander Simpson | University of Adelaide | Stijn Glorie | Martin Hand (UoA) | Anthony Reid (GSSA) | PhD | Development of laser ablation collision/reaction cell Lu-Hf geochronology | 17/05/2023 | Postdoctoral Researcher, British Geological Survey |
| 7 | Fernando Fontana | University of South Australia | Caroline Tiddy | Ben van der Hoek (UniSA) | Steve Tassios, Jess Stromberg, Neil Francis, Yulia Uvarova (CSIRO) | PhD | Laser-induced breakdown spectroscopy (LIBS) analysis for real- time downhole chemical assay | 13/06/2023 | Specialist Geologist - LIBS and Data Analytics, Rio Tinto |

Honours-Masters by Coursework Students

| Student | Affiliation | Degree | Project Title | Primary Supervisor | Co-Supervisor(s) & Affiliation(s) |
|-----------------------|---------------------------|--------------------------|---|-----------------------|--|
| Conor Dalton | University of Adelaide | Honours | Metal transport in active arc volcanic systems | Lucy McGee | Justin Payne (UniSA), Mark Reagan (Uni of Iowa) |
| Ziyu Yuan | | | | | |
| Zhaolin Hao | College London | Masters by | A mineralogical and geochemical toolkit for ore deposit targeting (Joint Project) | Caroline Tiddy | Adrienne Brotodewo (UniSA) |
| Zixuan Zhang | College London | COULSEWOLK | | | |
| Saifullah Abdul Qadir | Curtin University | Masters by Coursework | Simulation of electromagnetic acquisition systems for logging while drilling | Dr Brett Harris | Michael Carson, Hoang Nguyen, Aruni Rajanayake (Curtin) |



Appendix C Registered IP (Patents, Trademarks, Designs) MinEx CRC Limited 26 Dick Perry Avenue, Kensington, WA, 6151 PO Box 1130, Bentley, WA, 6102, Australia admin@minexcrc.com.au



Registered IP (Patents, Trademarks, Designs)

Patents

| PATENT FAMILY | RELATES TO | COUNTRY | APPLICATION NO. | FILING DATE | STATUS | MANAGEMENT |
|---|-----------------|---------------|--------------------|----------------|---|----------------|
| Borehole Logging Methods an Apparatus | AutoSonde | International | 2013904475 | 19 Nov '13 | Patent applications lodged in numerous countries by Boart Longyear | Boart Longyear |
| Sampling and Analysis System and Method for use | Lab-at-Rig® | International | 2014904646 | 19 Nov '14 | Patent applications lodged in numerous | Imdex |
| in Exploration Drilling | | | | | countries by Imdex | |
| Drying apparatus and related method | Lab-at-Rig® | International | 2014904649 | 19 Nov '14 | Patent applications lodged in numerous | Imdex |
| | | | | | countries by Imdex | |
| Capture of drilling fluid returns | Lab-at-Rig® | International | 2015903272 | Aug '15 | Patent applications lodged in numerous countries by Imdex | Imdex |
| Mobile Coiled Tubing Drilling Apparatus | CT Rig | International | 2017050508 | 30 May '17 | Patent applications filed in numerous countries by POF on behalf of MinEx | POF (MinEx) |
| High Speed Downhole Coring System | CT Rig | Australia | 2017101088 | 10 Aug '17 | Innovation Patent Granted, 8 years Next renewal 10 Aug '22 | POF (MinEx) |
| Sample Collection System and Parts Thereof | CT Rig, LAR for | International | 2018050938 | 31 Aug '18 | Patent applications filed in numerous | POF (MinEx) |
| | ст | | | | countries by POF on behalf of MinEx | |
| Rotary Drill Head for Coiled Tubing Drilling | CT Rig | International | 2017051098 | 11 Oct '17 | Patent applications filed in numerous | POF (MinEx) |
| Apparatus | | | | | countries by POF on behalf of MinEx | |
| Drilling Fluids and Uses Thereof | CTrol, CT Rig | International | 2019050486 | 21 May '19 | Patent applications filed in numerous | POF (MinEx) |
| | | | | | countries by POF on behalf of MinEx | |

Registered Designs

| DESIGNS | COUNTRY | APPLICATION NO. | FILING DATE | STATUS | MANAGEMENT |
|---|---------------|-----------------|-------------|---|-------------|
| | | | | | |
| Fluids Capture Apparatus | Australia | AU201514172 | 14 Aug '15 | Registered, 10 years, expiry due 14 Aug' 2025 | Imdex |
| | | | | | |
| Mobile Coiled Tubing Drilling Apparatus | International | AU201710287 | 18 Jan '17 | Registered various countries on behalf of MinEx | POF (MinEx) |
| | | | | | |
| A Cone Member for a Cone Splitter | Australia | AU201715232 | 1 Sep '17 | Registered, 10 years, renewal required at 5 yrs | POF (MinEx) |
| | | | | | |

Trademarks

| TRADEMARK | COUNTRY | APPLICATION NO. | CLASSES | FILING DATE | STATUS | MANAGEMENT |
|-------------|-----------|-----------------|---------------|-------------|----------------------|-------------|
| Lab-at-Rig® | Australia | 1581982 | 7, 9, 37 & 42 | 23 Sep '13 | Registered, 10 years | Imdex |
| RoXplorer® | Australia | 1664080 | 7,37 | 11 Dec '14 | Registered, 10 years | POF (MinEx) |
| CTrol® | Australia | 1827061 | 1 | 21 Feb '17 | Registered, 10 years | POF (MinEx) |



Appendix D Sponsors

Partners – FY22/23

List of Participants during the reporting period

| Participant's Name | ABN or ACN | Organisation Type | Category |
|--|---------------------|-------------------|-------------------|
| Anglo American Technical & Sustainability Serv Ltd | 81 629 813 216 | Industry | Large Miner |
| Australian National University | 52 234 063 906 | Research | University |
| BHP Billiton Iron Ore Pty Ltd | 46 008 700 981 | Industry | Large Miner |
| Commonwealth Scientific and Industrial Research Organisation (CSIRO) | 41 687 119 230 | Government Body | Statutory Body |
| Curtin University | 99 143 842 569 | Research | University |
| Epiroc Rock Drills AB | N/A (International) | Industry | METS |
| Geological Survey of New South Wales | 38 755 709 681 | Government Body | Geo Survey |
| Geological Survey of South Australia | 83 768 683 934 | Government Body | Geo Survey |
| Geological Survey of Western Australia | 69 410 335 356 | Government Body | Geo Survey |
| Geoscience Australia | 80 091 799 039 | Government Body | Geo Survey |
| Geotec Boyles Bros SA | N/A (International) | Industry | METS |
| Imdex Ltd | 78 008 947 813 | Industry | METS |
| LKAB Wassara AB | N/A (International) | Industry | METS |
| McKay Drilling Pty Ltd | 21 009 392 625 | Industry | METS |
| Minerals Research Institute of Western Australia | 86 779 457 072 | Government Body | Statutory Body |
| Rio Tinto | 12 002 183 557 | Industry | Large Miner |
| Sandvik Mining and Construction Oy | N/A (International) | Industry | METS |
| South 32 Ltd | 74 601 343 202 | Industry | Large Miner |
| The University of Adelaide | 61 249 878 937 | Research | University |
| University of Newcastle | 52 234 063 906 | Research | University |
| University of New South Wales | 57 195 873 179 | Research | University |
| University of South Australia | 37 191 313 308 | Research | University |
| University of Western Australia | 37 882 817 280 | Research | University |

List of Affiliates during the reporting period

| Affiliate's Name | ABN or ACN | Organisation Type | Category |
|-----------------------------------|---------------------|-------------------|-----------------|
| | | | Junior Explorer |
| AIC Mines Ltd (prev Demetallica) | 11 060 156 452 | Industry | |
| AuScope | 33 125 908 376 | Government Body | Statutory Body |
| Coresafe | 63 161 969 786 | Industry | Junior Miner |
| Datacode | N/A (International) | Industry | METS |
| Encounter Resources Limited | 47 109 815 796 | Industry | Junior Miner |
| EnviroCopper Ltd | 19 635 434 721 | Industry | Junior Miner |
| Evident | N/A (International) | Industry | METS |
| Geological Survey of Queensland | 59 020 847 551 | Government Body | Geo Survey |
| Geological Survey of Victoria | 83 295 188 244 | Government Body | Geo Survey |
| HiSeis Pty Ltd | 83 136 507 429 | Industry | METS |
| IFM Efector Pty Ltd | 48 083 423 938 | Industry | METS |

| Inca Minerals | 26 128 512 907 | Industry | Junior Miner |
|--------------------------------------|---------------------|-----------------|-----------------|
| Lodestone Mines Limited | 67 150 740 613 | Industry | Junior Miner |
| Matsa Resources | 88 613 060 352 | Industry | Junior Miner |
| MGPalaeo | 66 149 377 097 | Industry | METS |
| Middle Island Resources | 70 142 361 608 | Industry | Junior Explorer |
| Minalyze AB | N/A (International) | Industry | METS |
| Mineral Resources Tasmania | 36 388 980 563 | Government Body | Geo Survey |
| Monash University | 12 377 614 012 | Research | University |
| Northern Territory Geological Survey | 84 085 734 992 | Government Body | Geo Survey |
| Santos QNT Pty Ltd | 80 007 50 923 | Industry | Large Miner |
| Sercel SAS | N/A (International) | Industry | METS |
| Strategic Energy Resources Ltd | 14 051 212 429 | Industry | Junior Explorer |
| The Virtual Explorer (TVE) | 17 101 120 576 | Research | Other |
| Liniversity of Teenenie | 20 764 274 792 | Posoarch | University |

Changes to Affiliates & Participants during the reporting period

| Affiliate's Name | Retiring, Withdrawing or New | Department Approval |
|----------------------------|------------------------------|------------------------|
| Coresafe | Withdrawn | n/a |
| IFM Efector Pty Ltd | Withdrawn | n/a |
| Sercel SAS | Withdrawn | n/a |
| MGPalaeo | Withdrawn | n/a |
| Inca Minerals | Withdrawn | n/a |
| The Virtual Explorer (TVE) | Withdrawn | n/a |
| Monash University | New | Yes |

- Monash University joined MinEx CRC as a new Affiliate as of 10/2/2023 and was approved by the Board.
- Corsesafe, IFM Efector, MGPalaeo and Sercel SAS withdrew as Affiliates as of 30/06/2023.
- Inca Minerals withdrew as an Affiliate as of 31/3/2023.
- The Virtual Explorer (TVE) withdrew as an Affiliate as of 31/12/2022.